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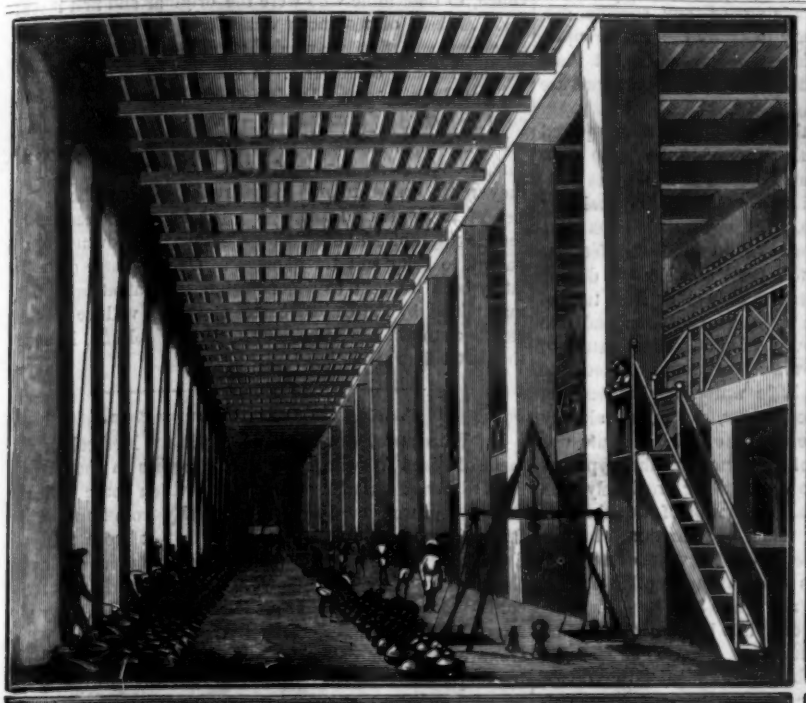

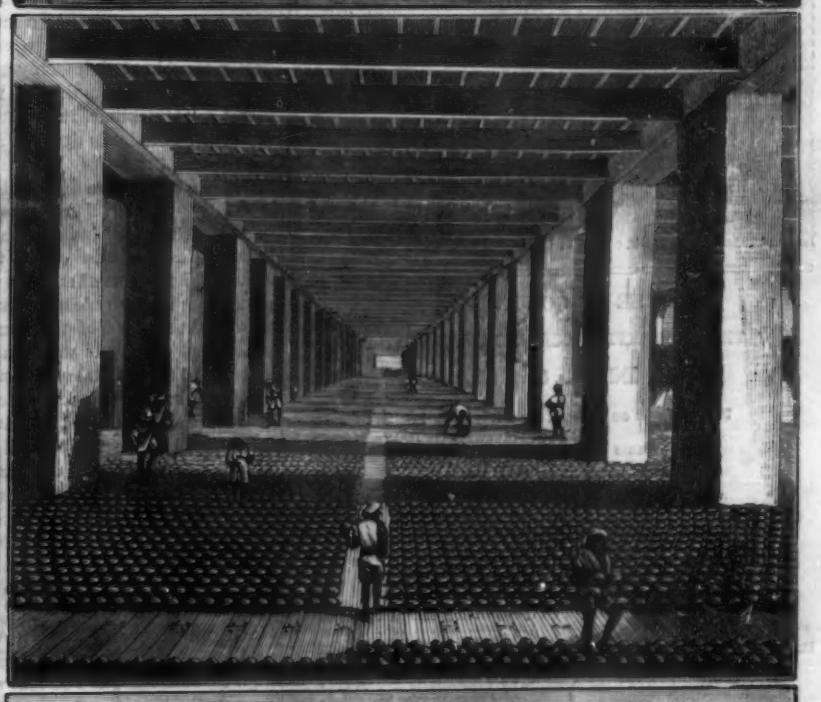

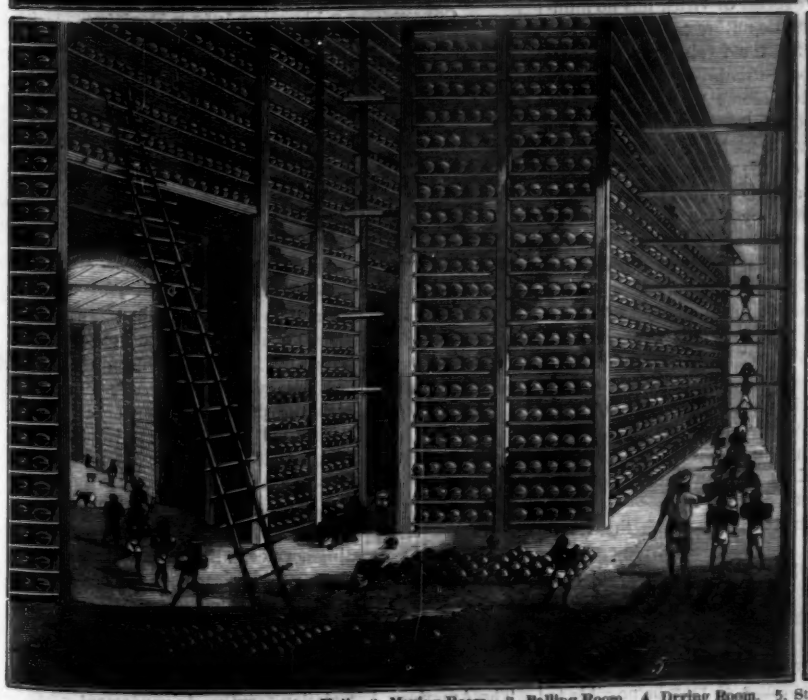

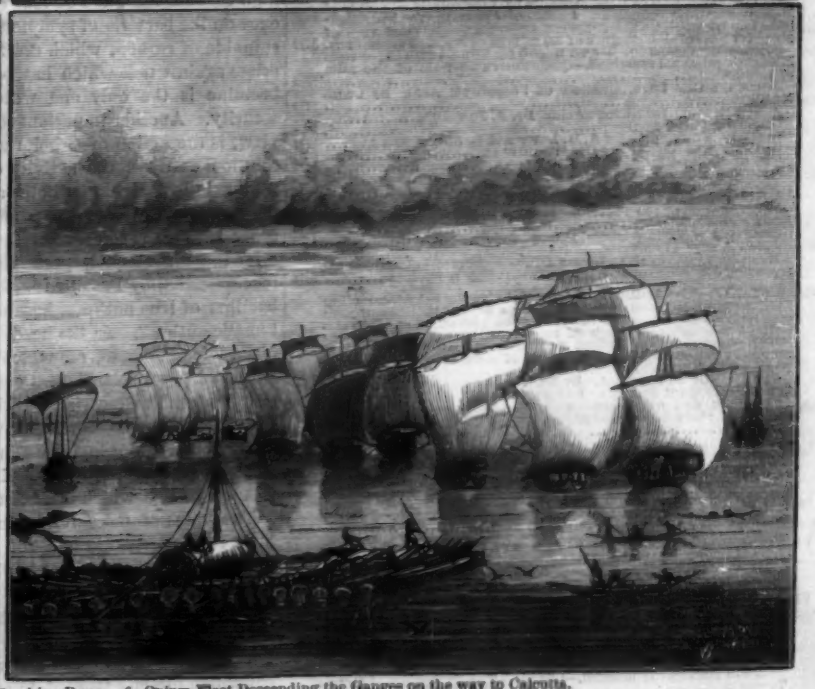

1. Examining Hall. 2. Mixing Room. 3. Balling Room. 4. Drying Room. 5. Stacking Room. 6. Opium Fleet Descending the Ganges on the way to Calcutta.

THE MANUFACTURE OF OPIUM.—[See page 60.]

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NEW YORK, SATURDAY, JULY 29, 1882.

Contents.

(Illustrated articles are marked with an asterisk.)

Agricultural inventions.... 74
Air, condensed moisture of..... 67
American Association, the..... 64
Atropine, etc., col. react..... 73
Billiard cue cutter*..... 66
Birds' nests, tree with 200 66
Boiler tubes, app. for draw., etc.. 73
Boracic acid, delet. effects of..... 70
Carbonic acid in the air..... 69
Carrier pigeons for naval service. 64
Cement, acid proof..... 66
Converting a neg. into a pos..... 64
Correspondence..... 68
Cotton, spont. comb. of..... 64
Cutter bar for reapers, etc.*..... 67
Drains, cutting by machinery*.... 66
Earths, about..... 69
Eclipse, recent, observations..... 68
Education in Japan 73
Electric lights, over 5,000 66
Engineering inventions..... 74
Faucet, hot and cold water*..... 73
Fasting in acute rheumatism..... 64
Fountain and bot. stop. attach.*.. 67
Glass, new variety of..... 69
Hektograph, the..... 64
Ice, microscopical examination*.. 71
International gas and elec. exhib. 67
Inventions, agricultural..... 74
Inventions, engineering..... 74
Inventions, index of..... 75
Inventions, mechanical*..... 73, 74
Inventions, miscellaneous*..... 73, 74
Leatheroid 64
Malaria in New England..... 67
Mechanical inventions*..... 73, 74
Mellogen..... 67
Metallic copper..... 67
Meter for steam heating 66
Micro-prismatic meth. for solids. 67
Mining cables..... 66
Motor and thrasher connection*.. 72
Nickel plating by boiling..... 67
Nitrite sol. of pot. iodide, etc. 67
Notes and queries..... 73
Opium, manufacture of*..... 65, 66
Pit dwellers of Yeso 70
Planets, aspects of for August.... 73
Plating org. bodies with metal... 68
Pulverizer, improved*..... 70
Research, imp. field for.. 64
Russell, John Scott*..... 71
Seed planter*..... 73
Transit of Venus, next 68
Woolen manufs., statistics of..... 70

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 348,

For the Week ending July 29, 1882.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ENGINEERING AND MECHANICS.—Logging in California.—The cutting and removal of redwood timber.—1 figure.—Train of cars loaded with redwood.—Humboldt Logging Railway..... 5467
A Barrel Boom..... 5468
The Telephone Indicator of the Torsion and the Speed of Revolution of the Moving Axle of Machines. By M. C. REGIO..... 5468
The Suez Canal.—A history of the canal enterprise.—4 figures.—The Couvreux excavator in the great El Guisr cutting, Suez Canal.—The Suez Canal in the Plains of Suez.—Present aspect of the Canal at Port Said.—View near Port Said..... 5464
The Jeannette Expedition.—A correction..... 5466
Improved Sponge Filter.—1 figure..... 5466
Improved Winding Gear for Mines.—2 figures..... 5466

II. TECHNOLOGY AND CHEMISTRY.—The Manufacture of Coal Tar Dyes.—Preparation of nitrobenzol and aniline.—3 figures..... 5470
The Deodorization of Impure Spirits by Electrolysis.—Process of Messrs. Naudin & Schneider.—4 figures.—Apparatus for hydrogenizing impure spirits.—Electrolyzing apparatus.—Sectional view of plant for a daily manufacture of 250 gallons of rectified alcohol..... 5472
Sesquichloride of Gallium. By M. LECOQ DE BOISBAUDRAN.—Sensibilities of principal reactions.—Quantitative analysis of the salts of gallium..... 5473
Notes on the Determination of Phosphoric Acid. By CARL MOHR..... 5473
A New Reagent for Nitrous Acid. Dr. A. JORISSEN..... 5474
Nitric Acid in Soils..... 5474
Crystalline Zirconia. By A. M. LEVY and L. BOURGEOISE..... 5474
Separation of Nickel. By Dr. A. JORISSEN..... 5474
The Rosaniline Question. By A. PABST..... 5474
Action of Sulphureted Hydrogen. By H. M. BAUBIGNY..... 5474
Process for Printing Aniline..... 5475
Protein Matters for Printing..... 5475
Fermentation of the Proteic Matters. By A. GAUTIER and A. ETARD..... 5475
Synthesis of Various Organic Compounds..... 5475
Bread Analysis in Massachusetts..... 5475
Emulsions. By Prof. C. LEWIS DIEHL.—Practical directions for preparing emulsions of cod-liver oil with other medicines..... 5475

III. BIOLOGY.—The Attitudes of Animals in Motion.—An interesting review by Mr. MUYBRIDGE of his studies of the motions of men and animals by means of instantaneous photography.—Description of apparatus.—Failure of artists to represent animals correctly.—Comparison of ancient and modern pictures with photographs of living animals.—Movements of men, of birds, etc.—The physiognomy of motion..... 5469
The Birth of an Elephant. By Dr. GUSTAVUS E. SUSSDORFF.—5 figures.—Elephant during and after labor.—Photo-micrographs of cow's milk and of elephant's milk.—Analyses of elephant's milk, and table of comparative analyses of human and animal milk..... 5476

IV. ELECTRICITY, ETC.—Effects Produced in a Vacuum by the Current of Gramme Machines. By MM. JAMIN and G. MANEUVRIER. 5475
Magnetic Variations of Magnetized Rods during Storms..... 5475

V. ASTRONOMY.—Facts and Fancy Concerning Comets. By Prof. E. L. LARKIN.—Velocities of bodies falling into the sun.—Possible heating effects of comets striking the sun..... 5477

VI. SPECTROSCOPY.—On the Spectrum of Carbon. By Professors G. D. LIVEING and J. DEWAR.—An important Royal Society paper.—Table of carbon lines.—Spectrum of incandescent carbon filaments..... 5471

VII. MISCELLANEOUS.—The Bombardment of Alexandria..... 5463
The City of Alexandria..... 5463
The Bombardment of Alexandria Heard 1,000 Miles..... 5464
The Khedive's Palace, Alexandria.—1 figure.—The Ras-el-Tin..... 5464
The Great Square at Alexandria.—1 figure..... 5464
A Forgotten Evolutionist..... 5467
Roman Honors to Garibaldi.—1 figure.—The Procession at Mount Tarpeia..... 5468
Population of the Earth.—Some curious calculations..... 5468

A NEW AND IMPORTANT FIELD FOR RESEARCH.

The hope of finding some substance not greatly injurious to higher forms of life and yet so fatal to all sorts of morbific germs that it would answer as a general disinfectant is not greatly encouraged by the progress of discovery. In their life habits and capacities the lower orders of living things—bacteria or what not—seem to differ almost as widely as the higher orders do. Conditions which kill one class are harmless to another while others specially thrive under them. And curiously, with varying conditions, the same germs may exhibit an enormously variable power to resist the action of germicides.

For example, the germs of the cattle plague symptomatic anthrax, after drying, are able to withstand disinfectants which quickly destroy the fresh virus. Thus it appears that for the certain antagonizing of any specific disease germs it will be necessary to study the action upon them not only of all the different disinfectants, but these separately under all the conditions in which the germs are likely to be met with.

An excellent illustration of the kind of work thus required is seen in the researches recently reported in the *Lyons Medicale*, by Arloing, Cornevan, and Thomas, in which was demonstrated the fact just noted as to the superior resisting power of dried anthrax virus. These investigations were undertaken to discover the effect of the various disinfectants in use when applied in turn to a particular class of disease germs. They were carried out with pulp taken from tumors in symptomatic anthrax, when in a fresh condition, and also when the matter had been slowly dried at a temperature of 95° Fah. The dried virus, even after two years' keeping, showed, when diffused in a little water, a virulence not exceeded by that of the fresh virus, while, as already noted, its power to resist the action of disinfectants was greatly increased. The test of virulence was the hypodermic injection of five drops, the virus having previously been subjected for forty-eight hours to the action of the substance whose antiseptic power was under examination. In this way it was found that (with respect to the virus of anthrax) many substances regarded as efficient antiseptics had no effect whatever on the fresh virus, while but few of the substances which destroyed the fresh virus had any effect upon the virus after it had been dried.

Reviewing the results of these experiments, the *Lancet* points out that pure or camphorated alcohol, which is largely used by surgeons to wash their instruments, is evidently capable of giving only an illusory safety against morbid germs. We should say rather this class of morbid germs. "Quicklime, in which it is often recommended that the bodies of animals dying of anthrax should be buried, and with which the walls of infected places are washed, is no better. At the moment of its hydration some organisms are probably destroyed by the heat which is disengaged, but those which are not in immediate contact with the lime seem to have preserved all their activity. Very thin layers of the tissue of the tumors of anthrax were taken and rolled up and plunged into the quicklime, and left in it for forty-eight hours. At the end of that time they were rubbed up with water, and the liquid was found to possess full virulence. The inutility of tannic acid suggests the question whether tanning is really adequate to destroy the poison in the hides of the affected animals, and it is clear that salting has no influence on the virus contained in the flesh, etc. Quinine, so powerful in the paludal diseases, which are now believed to be due to organisms, was found to have no influence over the bacteria of anthrax. Ammonia and its compounds were also powerless. Ammoniacal fermentation, therefore, which is said to destroy some bacteria, does not influence those of anthrax. Sulphate of iron, and chloride of manganese, substances which have been strongly recommended as disinfectants, were equally powerless. Further, the sulphurous acid, which is so potent in action upon some parasites of high organization, and on many forms of virus, has no influence on the bacteria of symptomatic anthrax. Chlorine and sulphide of carbon, which destroy the fresh virus, are powerless against that which has been dried. Of all the vapors bromine is the only one which seems to offer complete security. Another important result, from a surgical point of view, is the action of carbolic acid. A two per cent aqueous solution destroys the activity of the dry virus, but all the power is lost if the carbolic acid is mixed with alcohol. This fact has already been noted by Koch with regard to other kinds of spores. On the other hand, salicylic acid, mixed with alcohol, preserves its power. Turpentine, recommended by Pasteur for the purpose of destroying the bacillus of true anthrax, has no influence on that of symptomatic anthrax. At the head of the efficient agents stands corrosive sublimate, of which a solution of one in five thousand is sufficient; next come in order nitrate of silver, salicylic acid, and carbolic acid. A two per cent solution of the latter was found, however, only to destroy the organisms when it had been in contact with them for eight hours in the case of the fresh virus, and for twenty hours in the case of that which had been dried."

The value of these results in connection with the treatment of the disease in question need not be insisted on here. The great point to be kept in view is the importance of conducting similar investigations to discover the influence of possible germ killers upon the germs of diseases more especially afflicting humanity. For those diseases which are not transmissible to the lower animals, and consequently cannot be directly studied in animals, it may be possible to conduct operations with culture liquids. Having found artificial compounds in which the bacteria of the particular diseases to be studied are able to live and multiply, the potency or impotence of supposed germicides could be determined with these perhaps as well as with the living (human) organism. At any rate enough might be accomplished to prevent the mistake of trusting individual or public health in special cases, to the protection of disinfectants that would not disinfect, simply because the same substance had been found useful in other cases.

THE HEKTOGRAPH.

This is the well-known copying process in which gelatine transfer pads are used. Contests were carried on for a long time after its invention, before the United States Patent Office, to determine who were the original and first inventors. A mass of testimony was taken; but the priority of invention was finally awarded to Vincenz Kwaysser and Rudolf Husak, of Austria, to whom Letters Patent were granted June 1, 1880. During the progress of the interference proceedings hundreds of dealers began to make and sell the article, and it was difficult for them to understand that, now that a patent had been issued to the inventors, they must cease to manufacture or assume the liabilities of infringers. In some cases it became necessary for the Hektograph Manufacturing Company, the owners of the patent, to bring suit for damages. One of these suits has lately been brought to a conclusion, the patent being fully maintained by the United States Court, as will be seen by reference to the advertisement in another column, in which the particulars are fully given.

Fasting in Acute Rheumatism.

Dr. Wood, professor of chemistry in the Medical Department of Bishop's College, Montreal, reports in the *Canada Medical Record* a number of cases in which acute articular rheumatism was cured by fasting, usually from four to eight days. In no case was it necessary to fast more than ten days. Less positive results were obtained in cases of chronic rheumatism. The patients were allowed to drink freely of cold water, or lemonade in moderate quantities if they preferred. No medicines were given. Dr. Wood says that from the quick and almost invariably good results obtained by simple abstinence from food in more than forty cases in his own practice he is inclined to believe that rheumatism is, after all, only a phase of indigestion, to be cured by giving complete and continued rest to all the viscera.

A Colored Reaction of Atropine and Daturine.

If a specimen of either of these alkaloids or of their salts is covered with a little fuming nitric acid, let dry up on the water-bath, and when cold moistened with a drop of potassa dissolved in absolute alcohol, a violet color is instantly produced, and soon passes into a fine red. Only the violet color is characteristic, as strychnine also gives a beautiful red color if similarly treated. According to the author, 0·000001 grm. of atropine sulphate can thus be detected. None of the other important alkaloids give a similar reaction.—*D. Vitali.*

Spontaneous Combustion of Cotton.

During one of the hot days of June a Connecticut lady thought she smelled something burning up stairs. In searching for the fire she entered a small close garret room used for storage. She opened a window and instantly a bag of carpet rags hanging there burst into flame. The rags had been there all winter. The fire was promptly smothered; and when the bag was opened it was found that only balls of cotton rags were burned. Whether the rags had been dyed is not stated.

Converting a Negative into a Positive.

Capt. Bing, of Paris, has devised an ingenious method of making a positive on glass from a negative, and on the same glass. The back of the negative is covered with soluble bitumen or asphalt and then illuminated through the negative. After an exposure sufficient to render the light portion insoluble, the remainder of the asphalt is dissolved off with any of the usual solvents, leaving a positive. The silver negative is then dissolved off with the chloride of copper and a fixing agent, such as cyanide or hypo.

Leatheroid.

Leatheroid is a new article made of paper. It consists of a number of thicknesses of cotton paper wound one upon another over a cylinder. The remarkable qualities of strength and adhesion it possesses are derived from a chemical bath, through which the paper is drawn on its way to the cylinder. It is moulded wet, and retains its form. When dry, it cuts like raw hide.

CARRIER PIGEONS FOR NAVAL SERVICE.—The Secretary of the German Navy has resolved to employ carrier pigeons in the coasting service, all the experiments with them made by the Prussian Government on the coast of the North Sea, since 1876, to establish communication with the lightships lying off the coast having been successful.

The American Association.

The American Association for the Advancement of Science will meet at Buffalo, N. Y., August 23, next.

ASPECTS OF THE PLANETS FOR AUGUST.

VENUS

is evening star, and holds supreme sovereignty over her brother planets, as well as the myriad hosts that crowd the firmament on the moonless evenings of the last month of summer. The fairest of the stars is even more beautiful in aspect than she was during the last month. She has increased in size, her diameter now measuring fifteen seconds of a degree, instead of the thirteen seconds that marked her dimensions a month ago. She is longer, too, above the horizon after sunset, for she is still oscillating on her eastward track, traveling from the sun, and toward the earth. She will greatly increase in size and brilliancy before she completes her course as evening star. In December, her diameter will be sixty-four seconds, and she will be millions of miles nearer than she is at present. At the transit, she will be large enough to be seen by the naked eye through a smoked glass, as an exceedingly small dot.

Her course during the month is marked by one of the closest and most interesting conjunctions of the year. On the 2d, at 6 o'clock in the morning, she is in conjunction with Mars, being only five minutes north of him. Unfortunately, at the time of conjunction, both planets are below the horizon. But Venus will be at nearly the same distance from Mars on the evenings of the 1st and 2d, and near enough to make a lovely celestial picture on either evening. Five minutes is about one-sixth of the average diameter of the moon.

Those who watched the conjunction of Mars and Regulus on the 27th of June will be prepared to enjoy the far more beautiful and much closer conjunction of Mars and Venus in the early part of the present month. The approach of the planets before conjunction, and their seemingly rapid separation after conjunction, are worthy of note, as well as the more interesting scene when the two planets hang side by side in the sky. So close a conjunction between two planets has not occurred since the 18th of May, 1880, when Mercury and Neptune were one minute apart. So close a conjunction will not occur again until the 25th of June, 1884, when Mercury and Saturn will be one minute apart.

The present conjunction of Venus and Mars is not only rare, but takes place in a position and near a time when it may readily be observed, by simply glancing at the evening sky. The brilliant Venus will appear upon the scene an hour after sunset, in the glowing twilight of the west. As the shades of evening gather, a small red star will become visible a little distance to the south. This is Mars, dwindled to insignificant proportions by his distance from the earth, and shining feebly, while overpowered by the dazzling brilliancy of Venus.

On the 16th, Venus is in her descending node. This, at common times, would be a matter of little account; but when this beautiful planet passes, the next time, to her ascending node, she passes also between the earth and the sun, and makes the long-anticipated transit. If the orbit of Venus were on the plane of the ecliptic, we should have a transit at every synodic revolution; but as it is inclined nearly three and a half degrees, she is either above or below the ecliptic, excepting when at her nodes or crossing points. As the earth and Venus are both moving with different velocity, it is only at rare intervals that Venus is at one of her nodes at the time of inferior conjunction. As she will then be in line between the earth and sun, she must pass directly between them, and make a transit, just as the moon under the same conditions at new moon, causes an eclipse of the sun. The same laws govern both phenomena. Venus is so far away that she looks like a black dot passing over the sun's face. The moon is so near that she sometimes entirely hides the majestic orb.

Preparations for the transit are being carried on with increased ardor. The French parties have doubtless reached their destinations, and are hard at work, preparing and practicing for the great event. Two German expeditions have started on the same errand. The British Royal Astronomical Society has sent a portion of the valuable instruments prepared for the transit of Venus in 1874, to Oxford, to be used by Mr. Stone. Another portion of the same collection has been sent to the Observatory at the Cape of Good Hope. At both these points, the commencement of the transit will be visible, but not its close.

Venus sets on the 1st of the month, about 9 o'clock in the evening; at the close of the month, she sets a few minutes after 8 o'clock.

MARS

is evening star. The only item of interest connected with his movements throughout the month is his conjunction with Venus, which has already been described. Meantime, he keeps on his course, approaching conjunction with the sun; while Uranus recedes from him on the west, and Venus on the east. His right ascension is now 11h. 21m., and his declination is 4° 57′ north. He is passing into the constellation Virgo, and traveling rapidly south, so that at the end of the month his declination will be 3° 9′ south. Venus travels south still more rapidly. At the end of the month her right ascension is 13h. 22m., and her declination is 9° 52′ south. Thus the two planets that are now in the same right ascension, and differ but five minutes in declination, will then be far apart.

Mars sets on the 1st, at 9 o'clock in the evening; at the close of the month, he sets about a quarter before 8 o'clock.

URANUS

is evening star. A single incident varies the monotony of his course. He is in conjunction with Mercury on the 28th, the two planets being only eighteen minutes apart at 3 o'clock in the afternoon, the time of their nearest approach. The conjunction is one to be observed with the mind's eye, for the planets are both so near the sun that even the telescope will fail to bring them to view.

Uranus sets now a few minutes before 9 o'clock in the evening; at the end of the month he sets about 7 o'clock.

NEPTUNE

is morning star, and is the first of the morning trio to appear above the horizon. Although he rises before midnight throughout the month, he is numbered among the morning stars. Astronomers adopt the following classification for the outer planets. From conjunction to opposition they are morning stars, and are found on the western side of the sun. From opposition to conjunction they are evening stars, and are found on the eastern side of the sun. Neptune, Saturn, and Jupiter are traveling to opposition, and will be morning stars till they reach that goal.

On the 11th, at 7 o'clock in the evening, Neptune is in quadrature with the sun on his western side. He is then half way between conjunction and opposition, rising about midnight and setting about midday, being 90° west of the sun. Those who would follow the track of the outer planets should note the times of conjunction, quadrature, and opposition. Three outer planets, Neptune, Saturn, and Jupiter, are now moving from conjunction, the nearest point to the sun, to opposition, the nearest point to the earth. Two of them, Neptune and Saturn, reach quadrature during the month. Opposition, to terrestrial observers, is the most interesting of these epochs, for the planets are then nearest us, and, rising at sunset, are above the horizon during the entire night. This is the favorable opportunity for making discoveries on their surface, for they then reach their greatest size and brilliancy. When they get as far on the road as quadrature, it is time for telescopists to bestir themselves. If Neptune were nearer, we are reasonably sure that more than one moon would be seen revolving around him, and that belts would adorn his disk in a style of beauty befitting the rank of the third planet in the system.

Neptune rises now about half past 11 o'clock in the evening; at the end of the month, he rises about half past 9 o'clock.

SATURN

is morning star, and makes a fine appearance as in stately proportions he graces the eastern sky, rising a few minutes before midnight. He is now bright enough to be distinguished from the surrounding stars, though, in his best estate, he is not to be compared with Jupiter in size or the brightness of his shining.

On the 18th, at 6 o'clock in the evening, he reaches his quadrature or half way house, and thenceforth until opposition he will be nearer the earth than the sun. He will soon be a superb object in the telescope, with his moons, belts, and rings. His rings are opening to their widest extent, his perihelion is approaching, and his northern declination is specially favorable for observation. Thirty years must elapse before the same conditions occur again. If the present generation is destined to find anything new about Saturn, the discovery will probably be made between the present year and 1885, when these favorable conditions pass by.

Saturn now rises about a quarter of an hour before midnight; at the close of the month he rises about a quarter before 10 o'clock in the evening.

JUPITER

is morning star, and is glorious to behold, as, darting above the horizon in the small hours of the night, he rises with regal mien, and reaches a position half-way to the zenith before the sunbeams force him to retreat. His right ascension is now 5h. 48m., and his declination is 22° 45′ north. He is moving in the constellation Taurus, and his high northern declination brings him comparatively near the bright star Capella.

Jupiter rises now about twenty minutes after 1 o'clock in the morning; at the close of the month, he rises about a quarter of an hour before midnight.

MERCURY

is morning star until the 14th, when he comes into superior conjunction with the sun, passes to his eastern side, and is evening star for the rest of the month. We have alluded to his conjunction with Uranus on the 28th. Mercury is of little account during August, being too near the sun to be visible, and we must leave him to pursue his swift course under the beams of a fervid sun, that would destroy every vestige of life fitted for conditions that rule in our planet. For the sun, seen from the surface of Mercury, looks seven times as large as it does to us, and the mean solar heat and light are seven times as great as the heat and light received by the earth. The inhabitants of this planet, with their present organization, will have little desire to take up their abode in the planet that travels nearest the sun.

Mercury now rises at a quarter before 4 o'clock in the morning; at the end of the month, he sets about a quarter after 7 o'clock.

THE MOON.

The August moon fulls on the 28th. The waning moon is in conjunction with Neptune and Saturn on the 6th, and with Jupiter on the 9th. The new moon of the 13th is in conjunction with Uranus on the 16th, and with Mars and Venus on the 17th. But as our neighbor the moon approaches the planets at a respectful distance, the lunar conjunctions will not contribute largely to the interesting aspects of the August sky. She makes a nearer approach to Jupiter than to the other planets, her waning crescent hanging about two degrees south of him on the morning of the 9th.

THE AUGUST METEORS.

On the nights of the 9th, 10th, and 11th, there will be displays of celestial fireworks that never fail in their exhibition. The earth then plunges through the broad domains of an erratic number of the system known as the August meteor-zone. This zone is a gigantic ellipse or hoop, whose perihelion point is within the earth's orbit, and whose aphelion point reaches far beyond the orbit of Neptune. It is mysteriously associated, as Schiaparelli discovered, with the second comet of 1862, or has been gradually formed from its substance. The meteors are now distributed through every portion of the vast ring, though somewhat unequally. Therefore, every year, when about the 10th of August the earth crosses this zone, there is a shower of meteors, more or less abundant, according to the density of the cosmical cloud. The August meteors shoot forth or radiate from the constellation Perseus, which is therefore called the radiant point, and the meteors are called Perseides. Sometimes the showers are very brilliant, almost rivaling the famous November ones. At ordinary times, an observer may be reasonably sure of counting several hundreds on the nights mentioned. These meteors are usually yellow, and leave behind trails of luminous vapor that often last several seconds.

The meteoric downfall may be easily explained. The earth, traveling with a velocity of eighteen miles a second, plunges into a mass of cosmical atoms, whose velocity is increased by her attraction to thirty miles a second. The meteors impinge upon our atmosphere with this tremendous velocity, become vaporized by the concussion, and leave a train of luminous vapor behind them when they fall. This ring of meteors is calculated to be nearly eleven thousand million miles in diameter, and four million miles in breadth. These are figures of which finite powers can have little idea. But if we cannot grasp dimensions of such extent, we may be thankful for the capacity to enjoy the beautiful picture the heavens afford when these blazing stars wander in all directions through the infinite depths.

The fiery tears of St. Lawrence is the name given to the August meteors by the poetry and superstition of the past, because they fall on the anniversary of the day made memorable by the martyrdom of the famous saint. The constellation Perseus rises late in the evening in the northeast, and may be known by a circular row of bright stars marking the sword of the hero. Observers who watch for the meteors will be rewarded for their pains if there be only the usual display, while it may be that their watch will be rewarded by a shower of golden rain of unusual brilliancy.

August, then, promises abundance of employment for the student of the stars. Venus comes first on the list for her close conjunction with Mars, and for the queenly grace with which she reigns during the evenings of the last month of summer. The lordly Jupiter holds his court in the morning sky, and rewards with a glance of his beaming face the early riser who anticipates the dawn. The full moon lends her silvery radiance to the nights of the last week of summer. The August meteors give variety to the monthly programme, and illustrate the delightful uncertainty of cometic astronomy, for no mortal can prophesy whether a few hundred meteors will be imprisoned in our atmosphere, or whether the annals of the year will record an unusually abundant shower of golden rain.

Progress of Education in Japan.

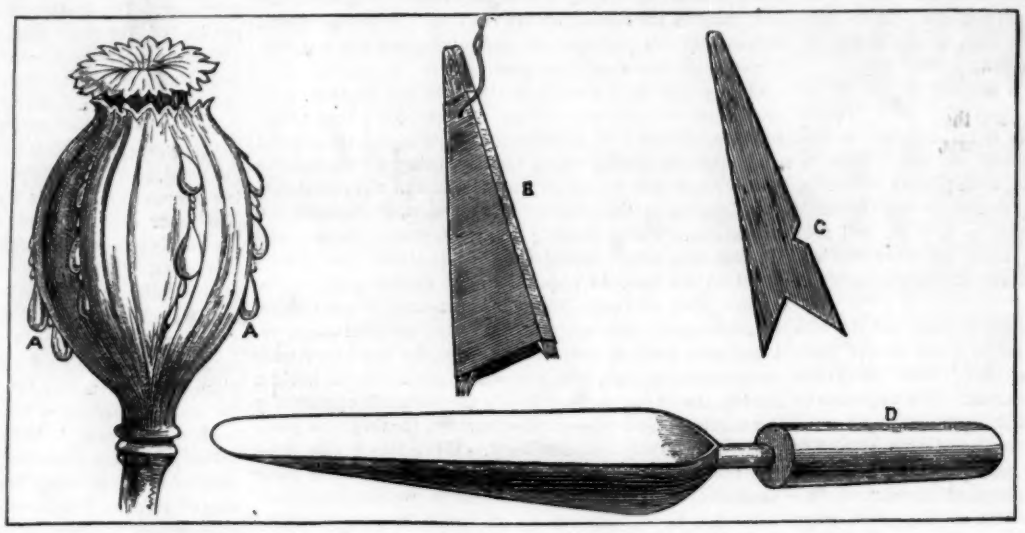
The seventh annual report of the Japanese Minister of Education states that there are 28,035 common schools in Japan, of which 16,710 are public, and the remainder private; there being an increase of 1,316 and 125 respectively, as compared with the previous year. The number of high schools is 107 public and 677 private, there being an increase of 42 and 63 respectively. Besides the above, many *Kindergarten* and primary schools were established. These private schools, even now, play a most important part in Japanese national life and education. Many of them have hundreds of students attracted by the fame of a single teacher. Youths flock from all parts of the country to sit at the feet of a renowned scholar, as men did in Europe to hear Abelard. The most celebrated of these leaders of youth—for this they are, rather than simple schoolmasters in our sense of the word—is Mr. Fukusawa, of Tokio, whose translations from European books and original works on the political and social questions of the day are read far and wide in Japan.

Nature says that the students of this gentleman fill many of the most important offices in the state; some of them recently formed themselves into a patriotic society, and established a newspaper, in which the acts of the government are subject to much caustic criticism. Long after the ordinary educational work of their teacher is done, and the young men have gone out into the world to do for themselves, they continue to reside near him, to study under his direction, and to form classes in which important public questions can be freely discussed under his guidance. One of his classes translated the whole of Adam Smith's "Wealth of Nations" into Japanese, with annotations, and many other important European works, especially those on philosophy and politics.

[FROM THE LONDON GRAPHIC.]

THE MANUFACTURE OF OPIUM.

Our engravings are from drawings by Lieut.-Colonel Walter S. Sherwill, late Boundary Commissioner, Bengal. They were made by him during a visit to the Patna factory, and were afterwards lithographed, with accompanying descriptions, in a volume printed for private circulation. They are of especial interest at the present time, when a number of persons, more or less influential, regard it as an immoral proceeding on the part of the Indian Government to derive a revenue from what they hold to be a baneful drug. Opinions greatly differ on this subject, and men of high authority and experience (Sir George Birdwood, for example) declare that opium is as much a necessity for the natives of the East as wine, spirits, and beer are for the natives of the West, and that the evils arising from its use are altogether less than those caused by the use or abuse of alcohol. We shall not here attempt any argument on the subject, preferring to summarize the official statement of Major Baring. For three years past the Indian opium crop has been short, and, coupled with this deficiency, there has been an increase in the production of Persian and Chinese opium. If the government monopoly of opium were abandoned, India would not only lose a revenue which would have to be made up by some other tax, but the extent of the poppy cultivation would almost certainly be largely increased in the hands of private growers. If the government went further than this, and altogether forbade the poppy cultivation, they could not stop the Chinese demand, which would then be supplied by inferior qualities of Persian and native Chinese growth.



A, A. Crude opium exuding from the green poppy-head.—B. Knife of four double-pointed blades for scratching the green capsule.
C. One of the blades of the knife, B.—D. Iron spoon for collecting the drops of opium.

We will now turn to the drawings of Lieut.-Col. Sherwill, who informs us that between 12,000,000 and 13,000,000 pounds of poppy juice (or upwards of 5,000 tons) are yearly gathered in Bengal. This yields a gross revenue of £6,500,000. The poppy is grown in the broad valley of the Ganges, and principally in those districts near Patna and Benares.

In the examining hall the consistency of the crude opium as brought from the country in earthen pans is simply tested, either by the touch, or by thrusting a scoop into the mass. A sample from each pot (the pots being numbered and labeled) is further examined for consistency and purity in the chemical test room.

In the mixing room the contents of the earthen pans are thrown into vats and stirred with blind rakes until the whole mass becomes a homogeneous paste.

The crude opium is then conveyed to the balling room, where it is made into balls. Each ball maker is furnished with a small table, a stool, and a brass cup to shape the ball in, a certain quantity of opium, a certain quantity of opium and water called "Lewa," and an allowance of poppy petals, in which the opium balls are rolled. Every man is required to make a certain number of balls all weighing alike. An expert workman will turn out upwards of a hundred balls a day. In the drying room the balls are placed to dry before being stacked. Each ball is placed in a small earthenware cup. Men examine the balls, and puncture with a sharp style those in which gas, arising from fermentation, may be forming.

In the stacking room the balls are stacked before being packed in boxes for Calcutta, *en route* to China. A number of boys are constantly engaged in stacking, turning, airing, and examining the balls. To clear them of mildew, moth, or insects, they are rubbed with dried and crushed poppy petal dust.

Lastly, we see an opium fleet of native boats conveying the drug to Calcutta. The fleet is passing the Monghyr Hills, and is preceded by small canoes, the crews of which sound the depth of water, and warn all boats out of the channel by beat of drum, as the government boats claim precedence over all other craft. The timber raft shown in the sketch has been floated down from the Nepal forests, and will be used in making packing cases for the opium.

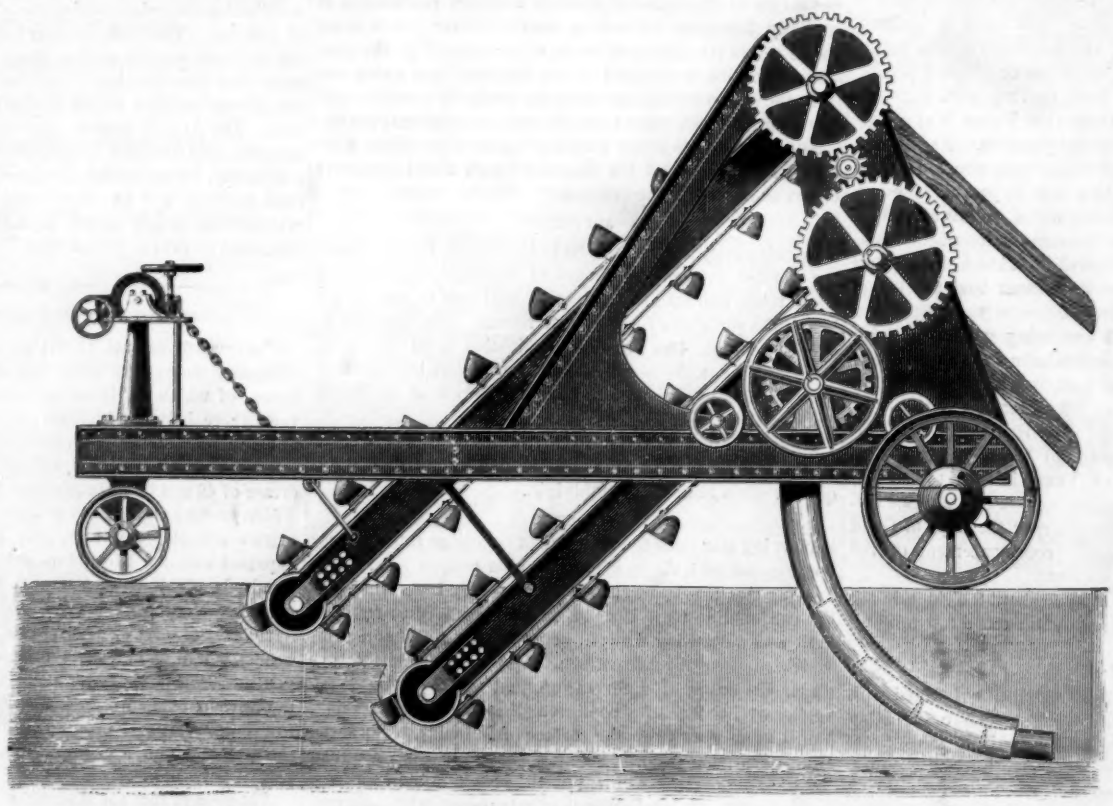
The drawings of the poppy head and the knife are of the natural size. The spoon is half the natural size.

A Tree with 200 Birds' Nests.

An old elm stands near the depot in Fair street, Kingston, N. Y., which is a favorite building place for birds. More than 200 nests have been counted among its branches this season, and the birds fill the old tree with song. It is the admiration of every visitor. Many go to hear the singing of the birds in the morning.

CUTTING DRAINS BY MACHINERY.

Numerous attempts have been made to supplant or assist manual labor by machinery in the cutting of drains. At the royal show at Derby, a machine for forming drains was exhibited by the Victoria Foundry Company, of Newark on-Trent. It was manufactured by Messrs. Abbot & Co., under the patent of Messrs. Robson & Hardman, and attracted a good deal of attention. The accompanying illustration, reproduced by permission from the Journal of the Royal Agricultural Society of England, will convey an idea of the construction of the machine.



DRAIN CUTTER.

Mr. John Coleman, the reporting judge, in describing the machine, says:

"The motive power is a wire rope from an ordinary plowing engine fixed on the headland. The drain is excavated by a series of revolving buckets cutting to the required depth and fall. These buckets are sharp-edged and very strong, as they have to act as scoops to remove as well as carry the soil. They are driven from the hind traveling wheel by a series of toothed wheels. Under the machine is a pipe conductor, by means of which the pipes are laid in the drain in front of the shoots, which deliver the soil cut out of the drain and brought up by the elevators, so as to cover up the pipes and fill the drain. This is very ingenious, and, provided the proper fall can be insured, which has always been a great difficulty with draining plows, this machine may prove of great value. The lower elevator, which takes out the bottom of the drain, deposits the material first, thus replacing the soil in the same relative position as it is removed. This is not always or usually desirable, and, if necessary, the process can be reversed. The frame is composed of strong iron plates, to which flange pieces are riveted. The motion is necessarily very slow. This machine was not in a sufficiently perfect state to admit of a trial—a matter of regret, as nothing in the way of mechanical aid to suffering agriculture at this juncture can be conceived as more valuable than a really efficient labor and money-saving drainage tool. Without a very exhaustive trial it is impossible to pronounce any opinion upon its present or possible future utility.

Mining Cables.

A valuable report by a French Government commission, on the rupture of cables in mines, appears in a recent number of the *Annales des Mines*. Among other points we note the affirmation that metallic cables, both steel and iron, may be used with as much security as cables of textile material, proper care being taken in providing and maintaining them (and more is needed). In very moist pits, especially with acid water, aloe cables are preferable; in pits, with return of air, and somewhat high temperature, metallic cables. Where flat cables are used, the textile allow of better equilibrating the motion of the engine than the metallic. Round metallic cables are more easy to make well than flat ones, and with conical or spiraloid drums, admit of regulating the engine's motion very conveniently. (French managers, it is stated, do not, in ordering cables, specify details and conditions of working sufficiently.) The resistance to rupture of hempen or aloe cables varies largely with choice of material and mode of manufacture, and careful experiments should be made with the yarn or cable (the cable should not contain more than 20 per cent of tar). The wires of a metallic cable should likewise be tested, both for flexure and torsion. Marks of fatigue of a cable generally appear outside; but with metallic cables, long used, it is well to make direct experiments on isolated wires, or on the ends. The importance of diameters of winding being as large as possible is greater for metallic than for textile cables, and for steel than for iron cables. The minimum diameter for iron cables should be 1,300 to 1,400 times that of the wire, and 2,000 for steel. It should be 80 to 100 times that of the cable diameter in metallic cables, and 50 times in textile. Thick metallic cables should not be worked beyond a tenth of the force required to break them; small round cables, a sixth; good aloe cable, a seventh, or an eighth. Cutting off the ends of a cable (too much neglected in France) should be done every two or three months. Once a week, at least, a cable should be passed for examination slowly up and down before the eyes of a competent agent. (Directions as to conveyance of personnel and various other topics are also given by the commission.)

ACID PROOF CEMENT.—Make a concentrated solution of silicate of soda, and form a paste with powdered glass. It will be found invaluable in the operations of the laboratory where a luting is required to resist the action of acid fumes.

IMPROVED CUTTER BAR FOR REAPERS AND MOWERS.

The engraving shows a novel cutter bar for reapers and mowers, which is contrived so as to admit of readily attaching or removing the knife sections for grinding or repairs.

Fig. 1 is a perspective view of the cutter bar, showing one of the fastening bolts removed. Fig. 2 is a plan view of a part of the bar, with the upper portion removed to show the studs for fastening the sections. Fig. 3 is a transverse section of the cutter bar, showing the relation of the various parts.

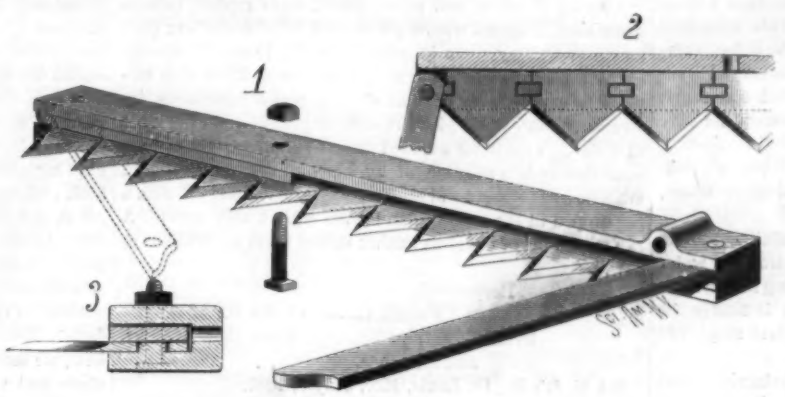
The holder for the knives consists of two bars having at their rear edges ribs or ledges forming bearing surfaces, and in the case of the lower bar the rib assists in supporting the knives.

The lower bar is provided with a series of studs or projections, between and around which the knife sections are fitted, each section being notched at opposite edges to fit around the studs.

Clamping pieces are placed above the knives, and bolts go through all the parts to clamp them securely together.

The advantages of this cutter are briefly as follows: The cutters, or any number of them, can be readily removed, as is often desirable. The cutters can be more rapidly and perfectly ground when removed from the bar. There are no screws liable to become loose by the vibration. Only one bolt has to be loosened in removing the cutters.

This invention was recently patented by Mr. Theodore Taylor, of La Grande, Oregon.



TAYLOR'S CUTTER BAR FOR REAPERS AND MOWERS.

Malaria in New England.

A short time ago the key to the mysterious extension of malarial diseases in New England was supposed to have been found in the damming of the streams for manufacturing purposes. Now the Boston *Advertiser* says that intelligent people living in the districts invaded say that the appearance of malaria in New England dates from the introduction of the cultivation of tobacco on a large scale upon the intervales of the Connecticut, and that its spread has kept even pace with the extended growing of this crop. The most plausible theory of the introduction and propagation of the aerial poison is this: The tobacco crop is a proverbially exhaustive one. To keep up the productiveness of the soil, fertilizers are freely used. The manure is brought from New York city, mostly in scows, which are unloaded on the banks of the river where the cargo is to be used. All the autumn and winter these heaps of putrid matter are fermenting and breeding disease. The air that comes in contact with these piles of filth is contaminated and rendered unfit for human lungs to inhale, as it is offensive to the senses.

A Proposed International Gas and Electric Light Exhibition.

The Crystal Palace Company, London, have determined to prepare for the next autumn and winter season a grand combination exhibition of gas and electric lighting, in which an unexampled opportunity will be accorded for showing what can be done with gas for all possible purposes. The exhibition will be of an international character, and the newest forms of electric lamps and systems of lighting, which were not included in the late show, with the help of some of the late exhibitors, may be relied upon to furnish the electrical part of the enterprise with a sufficiently representative collection.

What is wanted, says the *Journal of Gas Lighting*, to complete the symmetry of the scheme is, therefore, the assurance of hearty support from those interested in the production and utilization of gas, especially for illuminating purposes. It is the most important and satisfactory part of the proposal that lighting by gas, in direct competition with electric lighting, is indicated as the reason for holding the exhibition. It is not desired to have merely a collection of gas stoves or fittings, or even a brilliant show of lamps in stands belonging to different exhibitors. What is desired is an absolutely independent display of gas lighting, not specially designed to advertise the goods of competing gas apparatus makers, but to assert the advantages of gas as a general means of illuminating. The idea conveyed in this suggestion is admirable; it remains now to be seen how it can be carried into effect.

Nitrite Solution of Potassium Iodide and Starch Mixture.

The author has examined this mixture as regards its behavior with acid liquids. He used a very dilute potassium iodide starch paste, to which he added so much potassium nitrite that the liquid was colored deeply blue by a few drops of acetic acid. It was colored a deep blue by dropping in moderately dilute solutions of most inorganic and organic acids and acid salts, while weak and sparingly soluble acids, such as the carbonic, boracic, arsenious, uric, carbolic, tannic, had no action.—*A. Vogel.*

Metallic Copper as an Absorbent for Oxygen Gas.

The author has for some time been engaged with experiments on the use of metals at common temperatures as absorbents for oxygen in presence of ammoniacal vapors. This absorption proceeds with rapidity as long as bright metallic surfaces are exposed to a gaseous mixture containing oxygen, but ceases or becomes very slow as soon as appreciable quantities of oxide are formed. He has, therefore, examined if it is possible to effect complete absorption by using ammonium carbonate as a solvent for the oxides formed. Experiments proved that oxygen was quickly and completely absorbed in contact with copper and a solution of commercial ammonium carbonate, but that appreciable quantities of carbonic acid were evolved. Complete absorption of oxygen without the development of any gas was effected if it was exposed to metallic copper and a solution consisting of equal parts of a saturated solution of commercial ammonium sesquicarbonate, and a dilute solution of ammonia at 0·93. Such a liquid has a tension which may in most cases be disregarded, and if the apparatus contains sufficient quantities of metallic copper it is able to take up 24 vols. of oxygen.—*W. Hempel.*

Mellogen.

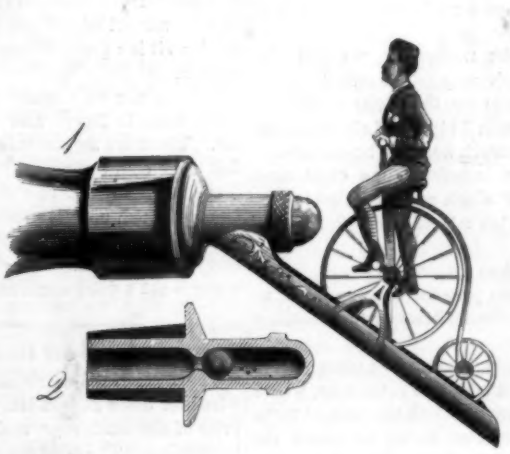
Mellogen, the new substance obtained by Signors Bartogli and Papasogli in their recent remarkable experiments of electrolyzing distilled water about six weeks—first with strong, then with weaker batteries and carbon electrodes—is a solid, dark, very shiny matter, soluble in hot water and in alkalies, insoluble in most mineral acids and in ordinary solvents, such as alcohols or benzine. It does not fuse, is not crystallizable, burns difficultly, and has strong coloring power. Its most salient property is its combining easily with oxygen, and giving rise to acids of the benzocarbonic series. The best oxidant is hypochlorite of soda. The formula of mellogen is $C_{11}H_3O_4$. If alkaline solutions be used as electrolytes in place of distilled water, mellic acid and its congeners are largely formed, but very little mellogen; on the other hand, with an acid electrolyte, the mellogen is abundant, and the former products are almost wholly wanting.

NOVEL ATTACHMENT TO FOUNTAINS AND BOTTLE STOPPERS.

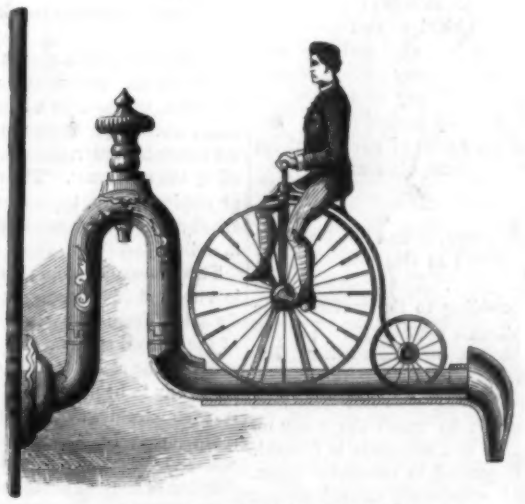
The engravings show two novel attachments which are set in motion by the passage of a fluid along a conductor with which they are connected. Figures 1 and 2 of the engravings show a bottle stopper with a spout connected therewith, arranged at an angle about 45 degrees with the axial line of the bottle; over this spout is placed a miniature bicyclist with the wheels of the bicycle extending down into the spout, where they may be acted upon by the discharge of liquid from the bottle. The spokes of the bicycle wheel are each provided with a float or paddle to afford an extended surface for the action of the fluid. When the fluid is poured from the bottle, the wheel revolves and drives the automaton figure, giving it an animated appearance.

The other device shown in the engraving is designed to be attached to soda and other drinking fountains, and operates in exactly the same way as the attachment to the bottle stopper shown in Figures 1 and 2, that is, the wheel revolves and moves the figure whenever the fluid is drawn. In both cases the spout which conveys the fluid is U-shaped in cross section, and the bicycle wheel extends down into it, where it can be acted upon by the fluid.

This novel device was recently patented by Mr. Fortonato C. Zanetti, of Bryan, Texas.



ZANETTI'S COMBINED TOY AND BOTTLE STOPPER.



COMBINED FAUCET AND TOY.

THE most ancient monuments of Mesopotamia and Egypt contained no mention of the horse, while the creature represented in Assyrian monuments had the tail of an ass. The first literary mention of the horse in Egypt belonged to a period of about eighteen centuries before Christ. From that time notices of horses in Egypt were frequent and common.

Condensed Moisture of the Air.

The author fills a glass funnel, drawn out to a point and closed at the bottom, with ice. The dew which condenses from the air on the cold sides of the funnel collects in drops, which run down over the closed point into a capsule. The quantity of water condensed in a given time may be measured, and the ammonia determined colorimetrically. By this cold distillation, it is possible to concentrate bodies which are decomposed at higher temperatures, *e. g.*, the odors of flowers. In the condensed dew may be found the microbia or parts of such thrown off from the body in disease.—*A. H. Smee.*

A Micro-prismatic Method for Solids.

The author makes use of the circumstance that particles of a transparent substance, if surrounded by a liquid which possesses a higher refraction index than the solid in question, display under the microscope very characteristic colors, the intensity of which increases with the difference of the refraction indices. If particles of a substance, however minute, are by degrees enveloped in liquids of different refraction indices, it is easy to find a liquid which produces the faintest intimation of these colors, and has consequently almost exactly the same refraction index as the body itself. If this is then determined for the liquid it is known for the body in question. The author uses as liquids, water, amylic alcohol, glycerine, oil of almonds, and oil of cassia. All bodies are of course excluded from this method which are opaque, or possess a refraction index higher than oil of cassia (1·606), or are attacked by the liquids.—*O. Maschke.*

Nickel Plating by Boiling.

Dr. R. Kaizer, according to the Bavarian *Gewerbe Zeitung*, prepares a bath of pure granulated tin, argols, and water, heats it to boiling, and then adds a small quantity of red hot nickel oxide. A portion of the nickel, as is shown by the green color which the solution assumes, that is, above the grains of tin, is immediately dissolved. If a copper or brass article be now immersed in this solution, it almost immediately becomes covered with a silver-like coating, which consists of almost pure nickel. If a little cobalt carbonate or cobalt tartrate be added to the bath, a bluish tint is produced, which may be made lighter or darker according to the quantity added. When the article is rubbed with dry sawdust or chalk, a very brilliant polish is obtained.—*Wiener Gewerbe Zeitung*, xl., 71.

ELECTRICAL motors have now been introduced at several French collieries. A Gramme machine has been in use for some time past at the Blanzy Mine; and others are at work in the Thibaud mines, belonging to the Terre-Noire Company, and at the Mine de la Péronnière.

Correspondence.

Plating Organic Bodies with Metal.

To the Editor of the Scientific American:

The short editorial notice in your last number (p. 17, vol. xlvii.) of Professor Christiani's method of preserving and plating with metal, flowers, leaves, insects, and other organic bodies, suggested the idea that a detailed description of similar processes for attaining the same end might be of interest and service to your readers. The following have been used by me for several years past, and in my hands have proven entirely satisfactory:

FOR SILVERING WITHOUT A BATTERY.

The object to be silvered, after being freed from adherent dust, dirt, etc., is immersed for two or three minutes in a saturated solution of gallic acid in distilled water. It is then dipped in a solution of 20 grains of crystallized nitrate of silver in 1,000 grains of distilled water. This operation is to be repeated two or three times, moving the object alternately from one bath to the other until it has acquired a silvery appearance. It is now rinsed in distilled water and laid on clean bibulous paper to dry. In the meantime have prepared two solutions as follows:

Reducing Solution.—Grape sugar or honey, 5 parts; quicklime (CaO), 2 parts; tartaric acid, 2 parts; distilled water, 650 parts. Mix, dissolve, and filter.

Silvering Solution.—Dissolve 20 parts of crystallized silver nitrate in 650 parts of distilled water. Add strongest water of ammonia, drop by drop, continuously stirring the solution with a glass rod, until the brown precipitate is nearly but not quite redissolved. Filter and put in a glass stoppered bottle.

If more of the reducing solution be made up than is needed for immediate use it should be kept in a closely stoppered vial, filled to the top, so as to prevent atmospheric action.

Equal parts of these solutions are mixed together in a gutta percha or japanned dish, and, after thorough stirring, filtered. The object to be silvered is immersed in the mixture, care being taken that the fluid shall come in contact with every part. The deposition of silver commences in from twelve to fifteen minutes, and continues for two or three hours, until the fluid is exhausted or the object sufficiently plated. The rapidity of deposition depends on the temperature, intensity of light, etc. After the object is plated it should be washed in a solution of carbonate of lime, rinsed in distilled water, and dried.

All sorts of organic matter may thus be treated and hermetically inclosed in pure metal. I have thus coated leather, bone, wool, hair, horn, silk, flowers, leaves, insects, and anatomical preparations. Glass, porcelain, and earthenware may be coated without first using the preparatory bath. If the latter (earthenware) be porous it will be necessary to first coat it with water glass or varnish, otherwise there is great waste of material.

I have before me a sprig of arbor-vitæ, on which a dragon fly is affixed, silvered by this method more than six years ago. The coating is without a visible break, though it has been somewhat roughly handled.

PROCESSES WITH A BATTERY.

The success of these processes depends upon making the surfaces of the objects to be plated good conductors of electricity. The principles and *modus operandi* are nearly the same in all of them. The object to be plated is immersed in a solution of some easily reducible metallic salt, and kept there until its surface absorbs more or less of it. It is then so treated chemically that the absorbed salts are reduced to a metallic state, and so intimately attached to and connected with the surface of the material to be plated that they will not peel off or separate under any ordinary circumstances. The subsequent treatment is the ordinary electrotypic or galvanoplastic one of plating with any desired metal. On account of their easy reducibility the salts of silver are those usually chosen for the preparatory manipulations.

CAZENEUVE'S METHOD.

Dissolve 40 parts of crystallized silver nitrate in 1,000 parts of wood spirit. Macerate the object in this solution until sufficient absorption has taken place. The length of time needed for this will vary according to the material, the horny shields of beetles, for instance, requiring much longer time than the softer parts, or than a piece of leather. Removing the object from this bath it is partially dried by draining off any surplus fluid attaching to it, and immersed in the strongest water of ammonia, by which the easily reducible double nitrate of silver and ammonia is formed. The object is now dried and suspended in mercurial vapor. In a few moments the surface is completely metallized, and can be electroplated in the ordinary manner. This method gives excellent results, especially for hard, compact, organic substances.

ORÉ'S METHOD.

This process is that which has recently been much used in France for plating anatomical preparations, and when properly manipulated gives exquisite results. The preparatory bath, like the foregoing, is silver nitrate dissolved in alcohol or wood spirit, six grammes of the salt to one liter of the fluid. In this the object is immersed for ten minutes, when it is taken out and carefully drained. It is then transferred to a close box, in which sulphureted hydrogen is liberated, and left for fifteen to twenty minutes. When it is removed the surface will be covered with a dark deposit of silver sulphide. The object should be exposed for a few minutes to the air before transferring to the galvanoplastic cell where the operation is completed. A human brain prepared by this process over a year ago is still a beautiful object, and bids fair to remain so for an indefinite period.

In using this method for the preservation of brains and such material the object should be kept in alcohol for at least one month to give it the requisite hardness and consistency. Pledgets of cotton should be introduced into the fissures so that the circumvolutions are separated and the preserving fluid may penetrate every part. The pledgets must be removed before plating.

From your short notice Professor Christiani's method seems to be a slight modification of Oré's (substituting phosphureted hydrogen for the sulphureted in the reduction of the silver nitrate).

TO KEEP SILVER PLATED ARTICLES BRIGHT.

Articles of silver and silver plated ware rapidly tarnish when kept in rooms where gas is used for illuminating purposes, and everywhere in cities like St. Louis, Pittsburg, Cincinnati, etc., where the air is constantly filled with sulphurous vapors. My cabinet of silver plated specimens, instruments, and water pitchers used to give no end of trouble this way. This is all avoided now by dipping the articles occasionally in a solution of hyposulphite of soda. Large articles, like pitchers and salvers, should be wiped off with a rag dipped in the solution, and dried with a soft towel. A rub with a bit of chamois leather makes them as brilliant as new.

Respectfully,

FRANK L. JAMES, Ph.D., M.D.,
Prof. Chem. and Tox., St. Louis Coll. of Phys. and Surgeons.

201 N. 6th St., St. Louis, Mo., July 8, 1882.

Meter for Steam Heating.

There is now on exhibition in this city an ingenious apparatus, invented by Mr. E. F. Osborne, of St. Paul, Minn., for controlling the admission of heat into buildings from a general steam-heating system in cities and for accurately recording the quantity of heat actually used. It consists substantially of two parts—a transmitter and a combined trap and meter; both of which in a compact form are intended to be placed in the cellar of any residence or place of business.

The transmitter resembles an ordinary upright tubular boiler in its appearance and functions—with this difference, that steam circulates through the tubes instead of the ordinary products of combustion, and communicating or giving forth its heat through the tubes converts water in contact with them into steam, which the consumer may use for warming rooms or for other purposes. As the steam generated from the water in the transmitter parts with its heat in being distributed through a building the water of condensation returns to the transmitter, as in ordinary gravity systems, at about the temperature of the steam. The local or consumer's circuit is entirely separate from the supply circuit; or, in other words, it is heat, not steam, which is sold. As water soon loses its heat when brought in contact with good conducting bodies of lower temperature it is only at and near the surface that the high temperature of the steam is maintained. Below this upper stratum no heat may be said to be transmitted from the steam of the "main" or street supply. If the user of the heat raises or lowers the level of this hot stratum he receives less or more heat just as he desires; and the mere moving of a weight on the arm of a pressure diaphragm regulator puts up or down the water level.

Below and at right-angles to the transmitter we find the combined trap and meter, which may be described as an iron tank, that acts as a receptacle for the water condensed in the transmitter from the "main" pipe, and also contains the meter for ascertaining how much heat had been abstracted by the consumer. The meter is essentially a compound or duplex pump, the pistons of which operate suitable mechanism that indicates on dials the rate of heat consumption in dollars and cents.

There is employed in this system a balanced return, which is a method of restoring by steam pressure the water of condensation from all parts of the "main" supply to the boilers of the central station.

When the steam from a "main" is sent to a place where its heat is to be utilized, it is first admitted to the trap, where it is freed from water, and it then goes into the transmitter in a dry state. In the transmitter, after having converted the water of the consumer's circuit into steam, through the conducting agency of pipes and diaphragms, the steam of the central station assumes the form of water, descends into the trap, sets the meter in motion, and returns under pressure to the boilers.

It will thus be seen that the users of the heat have the whole control of the amount they require; that the producers of the heat or the owners of the system are, as well as the consumers, fully and fairly notified of the rate of its consumption; and that, finally, as the water of condensation is returned to the steam generators at a very considerable temperature, there is a resulting economy which, in connection with the use of the meter, may not unreasonably be considered sufficient to bridge over the gap between success and failure, financially speaking, in the effort to heat separate buildings by steam from a general central source of supply.

The Osborne method has been adopted by the American Heating and Power Company of this city, and it is now being put in operation in a district east of the lower part of Broadway in this city.

Some Results of the Recent Eclipse Observations.

A writer in the New York *Sun* says: "The new observations seem to show pretty conclusively that the influence which produces sun spots is powerfully felt in the upper regions of the solar atmosphere, where it causes wonderful phenomena. Sun spots go in periods. Once in about eleven years they reach their maximum, or become most numerous. There was a solar eclipse in 1871 during a sun spot maximum, and another in 1878, when sun spots were very rare, and the astronomers observed a decided difference in the form of the corona or great gaseous envelope that surrounds the sun and blazes into sight during a total eclipse in the most fantastic and wonderful forms. The eclipse of this year fell in another period of sun-spot maximum, and it is an exceedingly interesting fact that the corona again presented the appearance seen in 1871. The most striking difference in the form of this magnificent atmosphere of the sun, as seen at sun-spot maxima and sun-spot minima, seems to be that when the spots are fewest the envelopes of glowing gases are deepest at the sun's equator, and also exhibit striking forms about his poles, while when the spots are most numerous, as at present, the corona extends away from the equator, and is not so conspicuous about the poles, but an enormous quantity of hydrogen appears in the solar atmosphere, glowing with the most intense heat. What a wonderful thing the sun appears to be in the light of these facts! Instead of a round, solid body, glowing with a white heat, we see in the sun a globe of gases subjected to a temperature and a pressure almost too frightful for the mind to conceive—a fiery globe in which iron and the solidest substances we know are not merely melted, but turned into a whirling mass of vapor, which is heaved and tossed with awful convulsions, while around it all, outside the sun as we see it, there is an indescribable atmosphere thousands and hundreds of thousands of miles deep, composed of glowing gases, some of which if condensed over our heads would set the world afire with red hot rain. Then we see, through some cause which we cannot yet understand, this ball of flaming gases, which is rushing through space like a hot shot hurled from a cannon of infinite power, lashed every eleven years into seven-fold fury, until its glowing surface is pitted with tremendous chasms, and jets of flaming hydrogen and other gases leap from it like gigantic geysers of fire and set its great upper atmosphere aglow.

"Another interesting result of the recent eclipse observations is the evidence obtained of the existence of enormous quantities of vaporized calcium in the corona, or upper atmosphere of the sun. If this is so, then we see an element which, in limestone and other combinations, forms whole ranges of solid mountains on the earth changed to the condition of a shining vapor, and serving to make up part of the atmosphere of the great orb of day. The existence of calcium in what may be called the body of the sun was recognized long ago, but heretofore there has been no good evidence that this terrestrial mountain-making element was floating at a tremendous elevation above the surface of the sun.

"Again, the recent observations have, it appears, gone far toward proving, what has been for many years suspected, that the chemical elements as we know them are not able to withstand the tremendous temperature of the sun, and that they are thus split up into still more elementary substances, an achievement far beyond the power of our chemistry. If this is so it is a great advance in the spectroscopic study of the sun.

"These are only some of the discoveries made by the astronomers in Egypt, and which have been so slow to leak out. There are a great many other things of public interest that they could throw light on; for instance, the sword-shaped comet which they discovered close to the sun and photographed, and the discovery of indications of an atmosphere in the moon, the particulars of which would interest everybody, especially if they can give us any hope that the moon is not a dead world after all."

Over Five Thousand Electric Lights in One Building.

The Mills Building, Wall and Broad Streets, has been wired for 5,588 Edison lamps. As this is the largest enterprise of the kind ever undertaken the details may prove interesting. The conductors consist of 1,650 feet of Edison's patent electric tubes, 628 feet of lead pipe containing taped wires thoroughly insulated, 23,658 feet of zinc tubes, 75,909 feet of wire conductors, and 24,162 feet of wooded receptacles, placed between the floors, to hold the system of distributed wires. The total amount of wires used was 3,774 lb., besides 48 vertical main cut-outs, and 253 division cut-outs. The work was done by the wiring department of the Edison Illuminating Company of New York, under contract with Mr. D. O. Mills, the owner of the building.

The Next Transit of Venus.

Two German expeditions will go to American stations in order to observe the transit of Venus in December next. Observations will be taken at Stratford, Connecticut; at Aiken, South Carolina; at Bahia, Blanca; and at Punta Arenas.

The Normal Amount of Carbonic Acid in the Air.

In a lecture before the Paris Academy, M. Dumas presented the following address on the present state of our knowledge of this interesting subject.

Of all the gases that the atmosphere contains there is one which offers a special interest, as well on account of the part ascribed to it in the mutual interchange going on between the two organic kingdoms, as on account of the relation that it has been observed to occupy between earth, air, and water; this gas is carbonic acid.

Ever since the fact has been established that animals consume oxygen and give out carbonic acid as the product of respiration, while plants consume carbonic acid and give out oxygen, the question has often been asked whether the quantity of carbonic acid contained in the air did not represent a sort of sustaining reservoir which was being continually drawn on by the plants and resupplied by animals, so that it has doubtless remained unchanged owing to this double action.

On the other hand, Boussingault has long since shown that volcanic regions give out through crevices and fumaroles enormous quantities of carbonic acid. The deposition of carbonate of lime that is continually taking place on the sea bottom is, on the other hand, fixing carbonic acid in quantities which we may accurately estimate from the strata of limestone seen on the surface of the earth. We might imagine, that in comparison with the huge volumes of carbonic acid sent forth in volcanic districts, even in the oldest one, and the mass of carbonate of lime deposited on the sea bottom, the results attributed to the life of plants and animals would be of no consequence either for increasing or diminishing the physiological carbonic acid in the air comparable with those which are accomplished by the purely geological exchange.

Schloesing has recently succeeded, by a happy application of the principle of dissociation, in showing that the amount of carbonic acid in the air bears a direct relation to the quantity of bicarbonate of lime dissolved in sea water. If the quantity of carbonic acid diminishes, the bicarbonate of the water is decomposed, half of its carbonic acid escapes into the atmosphere, and the neutral carbonate of lime is precipitated. The aqueous vapor condensed from the air dissolves part of the carbonic acid contained therein, and carries it along, when it falls as rain upon the earth, and takes up there enough lime to form the bicarbonate, which is thus carried back to the sea.

The physiological role of carbonic acid, its geognostic influence, and its relations to most ordinary meteorological phenomena on the earth's surface—all these contribute to give special weight to studies concerned in the estimation of the normal quantity of carbonic acid in the air.

Nevertheless, this estimation is attended with great difficulty. Not every one is able to take up such questions, and not all processes are adapted to it. The first thought which would naturally arise would be to inclose a known volume of air in a given vessel, and then determine its carbonic acid by measuring or weighing it. In this way we should obtain the exact relation between a volume of air and the volume of carbonic acid in it, for any given moment, and in any given place. If, however, this be done with a ten-liter flask, for example, it would only hold 3 c. c. of carbonic acid, weighing 6 milligrammes, and whether it is weighed or measured, the error may easily equal 10 per cent of the real value, hence no deductions could be drawn from the observed facts.

For this reason larger volumes of air were taken, and a current of air, whose volume could be accurately measured by known methods, was passed through condensers capable of retaining the carbonic acid. But in this case the air must pass very slowly through it, so that the process may last several hours; and since the air is continually in motion, owing to vertical and horizontal currents, the experiment may be begun with the air of one place, and concluded with air from a far distant spot. For example, if an experiment lasting 24 hours was made in Paris when the air moved but four meters per second (9 or 10 miles per hour), it might be begun with air from the Department of the Seine, and end with air from the Department of the Rhone, or the Belgian frontier, according to the direction of the wind.

So long as we had no analytical methods of sufficient delicacy to estimate with certainty the hundredth, or at least the tenth of a milligramme of carbonic acid, it was very difficult to determine the quantity in the air at a given time and place. It is frequently possible to analyze upon the plain air that has descended from the heights above, and to examine by bright daylight the effect of night upon the atmosphere.

Still other difficulties show themselves in such investigations. It seems very easy to collect carbonic acid in potash tubes, and to determine its amount from the increase in weight of the tubes; but alas! to how many sources of error is this method exposed. If the potash has been in contact with any organic substance, it will absorb oxygen. If the pumice that takes the place of the potash contains protoxide of iron, it will also absorb oxygen. In both cases, the oxygen increases the weight of the carbonic acid.

Every experimenter who has been compelled to repeat the weighing of a somewhat complicate piece of apparatus, with an interval of several hours between, knows how many inaccuracies he is exposed to if he is compelled to take into calculation the changes of temperature and pressure, and the moisture on the surface of the apparatus. After fighting all these difficulties, and frequently in vain, the experimenter begins to mistrust every result that depends only on difference in weight, and to prefer those methods whereby the substance to be estimated can be isolated, so that it can be seen and handled, weighed or measured, in a free state, and in its own natural condition.

The classical experiments of Thenard, of Th. De Saussure, of Messrs. Boussingault, on the quantity of carbonic acid in the air, are well known to every one; they need only to be organized, repeated, and multiplied.

J. Reiset, who has conducted a long and tedious series of experiments on this subject, has adopted a process that seems to offer every guarantee of accuracy. The air that furnishes the carbonic acid is aspirated through the absorption apparatus by two aspirators of 600 liters capacity. The temperature and pressure of the air are carefully measured. The carbonic acid is absorbed by baryta water in three bulb apparatus. The last bulb, which serves as a check to control the operation, remains clear, and proves that no binoxide of barium is formed. The baryta water used is titrated before and after the operation, and from the difference is calculated the quantity of carbonate formed, and hence of the carbonic acid.

These tedious experiments, which varied in duration from 6 to 25 hours, require at least two days of continuous labor. They were repeated 193 times by Reiset in 1872, '73, and '79. They were made in still weather, and in violent winds and storms. The air was taken at the sea shore, in the middle of the fields, on the level earth, during harvests, in the forests, and in Paris. Under such varied conditions, the quantity of carbonic acid varied but little; the numbers obtained were between 2·94 and 3·1, which may be taken as a general average of the carbonic acid in the air.

The quantity of carbonic acid in the free atmosphere is tolerably constant, which must necessarily be the case according to Schloesing's proposed relation between the bicarbonate of lime in the sea and the carbonic acid in the air. The only cause that seems at all competent to change the geological quantity of carbonic acid in the atmosphere is the formation of fog. As the aqueous vapors condense, they collect the carbonic acid; and the foggy air, as a rule, is more heavily laden with this gas than ordinary air.

It is not surprising that there is less carbonic acid in the air collected on clear summer days, in the midst of clover, etc., that is, in an active reducing furnace; if anything is surprising it is that the quantity of carbonic acid does not sink below 2·8.

It is also a matter for surprise that in Paris, among so many sources of carbonic acid, the furnace fires, the respiration of men and animals, and the spontaneous decomposition and decay of organic substances, the quantity of carbonic acid does not exceed 3·5.

If, then, the great general mean of normal atmospheric carbonic acid deviates but little from 2·9 or 3·0, it is not doubtful that under local conditions, in closed places, and under exceptional meteorological conditions, considerable variations may occur in these proportions. But these variations do not affect the general laws of the composition of the atmosphere.

There are two entirely distinct points from which the measurement of the atmospheric carbonic acid may be contemplated.

The first consists in considering it as a geological element which belongs to the gaseous envelope of the earth in general, and it leads us to express the general relation of carbonic acid to the quantity of air, as about 3 volumes in 10,000.

The second, which relates to accidental and local phenomena, to the activity of man and beast, to the effect of fires and of decomposing organic matter, to volcanic emanations, and finally to the action of clouds and rain, permits us to recognize the changes which can occur in air exposed to the influences mentioned, and to a certain extent confined. Without denying that it is of interest from a meteorological and hygienic standpoint, it does not take the same rank as the first.

J. Reiset's experiments, by their number, accuracy, the large volumes employed, and the interval of years that separate them, have definitely established two facts on which the earth's history must depend; the first is, that the percentage of carbonic acid in the air scarcely changes; the second, that it differs but little from $\frac{3}{10000}$ by volume.

These results are fully confirmed by the results which were obtained by Franz Schulze, in Rostock, in 1868, '69, '70, and '71. The averages which he got, with very small variation, were 2·8668 for 1869, 2·9052 for 1870, and 3·0126 for 1871.

More recently Muentz and Aubin have analyzed air collected on the plains near Paris, on the Pic du Midi, and on the top of Puy-de-Dome. Their results agree with those published by Reiset and Schulze.

The grand average of carbonic oxide in the air seems to be tolerably fixed; but after this starting point is established, it remains to study the variations that it is capable of, no from local causes, which are of little importance, but from general causes connected with large movements of the air. Upon this study, which demands the co-operation of a definite number of observers stationed at different and distant points of the earth, the experiments being made simultaneously, and by comparable methods.

M. Dumas called the attention of the Academy to this point, in connection with its mission of selecting suitable stations for observing the transit of Venus. The process and apparatus of Muentz and Aubin offer the means adapted for making these experiments, and seem sufficient to solve the problem which science proposes, of determining the present quantity of carbonic acid in the air.

If these experiments yield satisfactory results, as we have good reasons to believe they will, it is to be hoped that annual observations will be made in properly chosen places, so as to determine the variations which may possibly take place in the relative quantity of atmospheric carbonic acid during the coming century.—*Compt. Rend.*, p. 589.

[Although this proposition was made by a Frenchman to his fellow scientists, would it not be well for some American to accept the challenge, and bring it before the coming meeting of the American Association for the Advancement of Science, in the hope that we too may contribute our mite of effort in the same direction?—ED.]

About Earths.

While chemistry was under the dominion of fancy and metaphysics, before the establishment of the maxim that facts are to precede and serve as the basis of all reasonings in natural science, it was imagined that all material substances were resolvable into four simple bodies, viz., air, fire, water, and earth, which were hence called the four elements. The two first were avowedly almost wholly unknown, most liquids were supposed to be modifications of the third, and the solid particles of bodies were attributed to the last. Earth in this extended sense was chiefly characterized by the properties of hardness and solidity, and was subdivided into various species, according to the supposed modifications that it underwent. Thus the class of combustible bodies was imagined to contain more or less of an inflammable earth, the various metals were considered as abounding with a metallic or mercurial earth, and so on of the other great classes into which solids are divided. These several earths, however, were considered as only modifications of the primitive elementary one. Modern chemistry, though it has retained the term in a much more restricted sense than it was applied formerly, has yet included under it a sufficiently heterogeneous assemblage of bodies, a considerable portion of which may much more properly be considered as belonging to the class of alkalies.

The principal earths that are at present known are as follows: Silex, zircon, alumina, glycine, yttria, barytes, strontian, lime, and magnesia. When purified by art from all foreign mixtures they agree in the following properties: 1, They are of a snow-white color; 2, are infusible by a very intense heat; 3, are not reducible to the metallic state by being heated in contact with combustible matter. Of these nine earths, however, the four last have all the properties of alkalies (whence indeed they have sometimes been called alkaline earths), not differing from potash or soda so much as these do from ammonia. If, therefore, we were to confine the term earth to the five first, this double advantage would accrue from the arrangement, that the two classes of alkalies and earths would each admit of a genuine chemical definition, which they both equally want at present.

If such an arrangement were adopted, the remaining earths would be thus characterized: They are infusible and insoluble in water, and have neither taste nor smell; they exhibit neither acid nor alkaline characters; they combine with acids and with alkalies either pure or carbonated; they have no action on metallic substances, and are incapable of assuming the reguline form.

A considerable stir was made many years ago in Hungary by the pretended metallization of several earths by MM. Reprecht and Tondi, till their experiments were repeated by Klaproth and others, and shown to be entirely fallacious. The chemists first mentioned took a small quantity of any earth—barytes, for example—and, having beaten it up with a little water and charcoal, smeared it on the inside of a Hessian crucible; the cavity was then filled with powdered charcoal, and at the top of all was placed a layer of bone ash; a cover being then luted on, the crucible was exposed for three-quarters of an hour to a blast furnace, in which it was heated almost to a state of pasty fusion. When the contents of the crucible were examined, the barytes was found in part melted with the earth of the crucible, and containing from two to four per cent of brittle metallic globules, which were supposed to have originated from a decomposition of part of the barytes. These globules, however, on examination by Klaproth, proved to be nothing more than phosphuret of iron; the metallic part doubtless originating from the iron contained in the earth of the crucible, and the phosphorus from the bone ash by means of the charcoal. That this is the true explanation of the appearance is evident from another experiment of Klaproth, in which he repeated the process of Ruprecht, only substituting a porcelain for a Hessian crucible; but the earth of the crucible contained no iron, and there was not the slightest appearance of metallic globules in the barytes which it contained. Further, the experiment was again repeated in a Hessian crucible, only leaving out the barytes, and the globules made their appearance as plentifully as when the barytes was present.—*Glassware Reporter.*

A NEW VARIETY OF GLASS.—A chemist of Vienna has invented a glass which contains no silex, potash, soda, lime, or borax. In appearance it is equal to the common crystal, but more brilliant; it is transparent, white, and clear, and can be cut and polished. It is insoluble in water, and is not attacked by fluoric acid, but it can be corroded by hydrochloric and nitric acid. When in a state of fusion it adheres to iron, bronze, and zinc.

IMPROVED PULVERIZER.

We give an engraving of the Thompson Patent Pulverizer, improved by Stephen P. M. Tasker, of the firm of Morris, Tasker & Co., Lim., of Philadelphia. It has been so changed by Mr. Tasker that nothing now remains of the original mill but the ball held between flexible disks. These improvements are the result of experiments made at the Pascal Iron Works and during a year and six months' run at the mines. It is now perfected as a machine; and for the reduction of ores, etc., it stands, as we believe, unequaled. The efficient working of the mill cannot be realized unless it is seen in operation.

As the motion is a simple rolling motion no foundations are necessary. The pedestals are supplied with screws for raising or lowering the journal-bearing boxes in the event of the mill being set out of plumb.

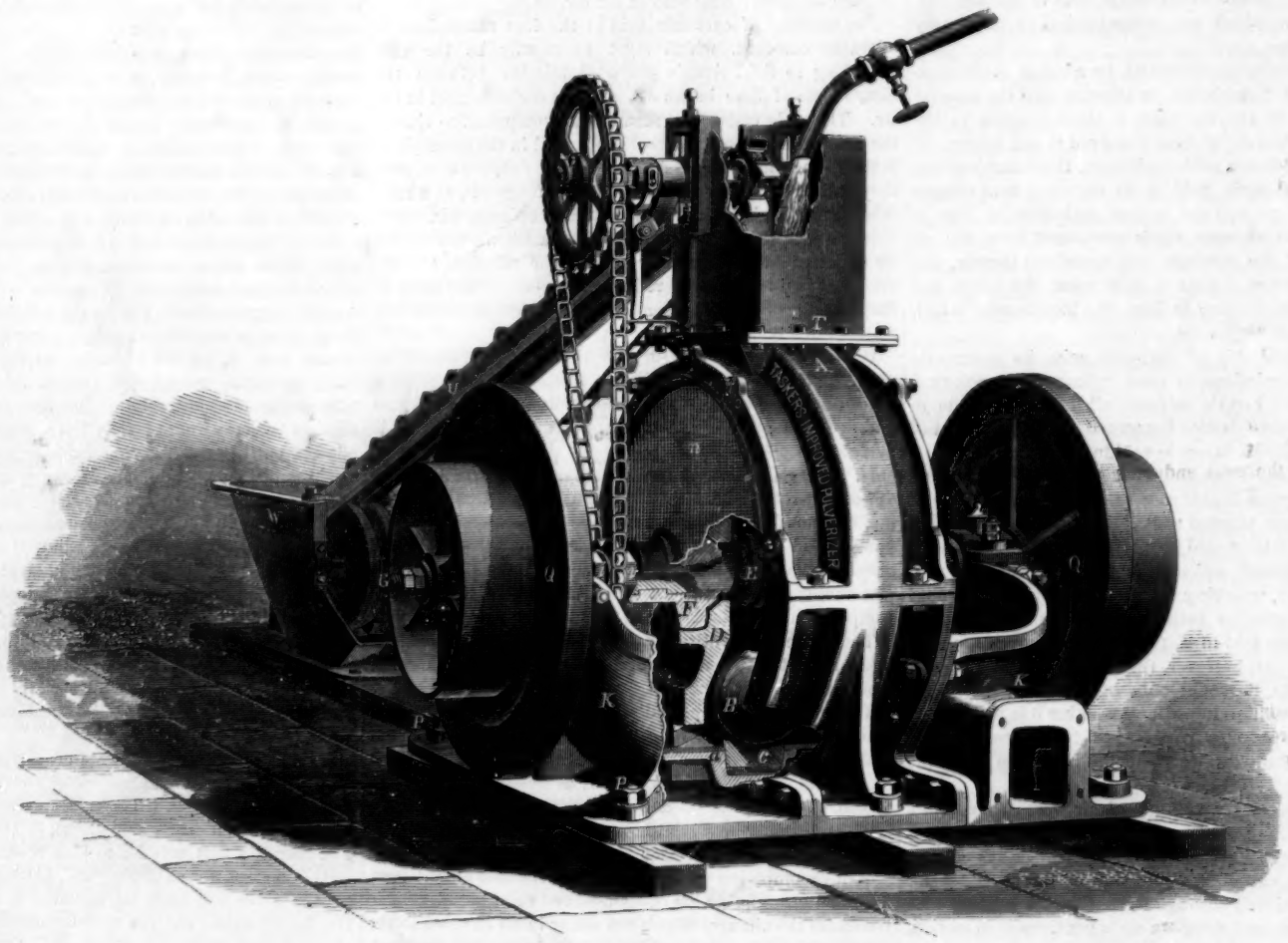
In this mill centrifugal force is given to a *loose* ball. This is a principle which we believe has never been correctly applied before. The ball, B, is carried around the inner periphery of a steel shoe ring, C, by means of flexible disks, B, whose surfaces are chilled where they touch the ball to prevent wear. The disks are set up by means of nuts, I, on the shaft on the outside of the screen frames, and they are kept apart by a strong steel spring, E, between them on the shaft. The disks are carried by the clutches, which are fast to the shaft. On the sides of the machine are the screens, N. As the ore is fed in at the top by the automatic feed it drops into the mill, and, after being pulverized, is washed under the edges or rims of the disks, which have a clearance of one-eighth inch. All that is fine enough passes through the screen; that which is too coarse is caught in the take-ups and forced back under the ball again until it is fine enough to pass through the screens.

The fineness depends on the number of mesh of the screen and the quantity of water used; the more water used up to a certain quantity, the more pulp will be washed out. With very little water a less quantity will be done, but it will be very much finer. To give the mill all the water that can be used requires but 400 gallons per ton of pulverized ore. This compares very favorably with the amount of water used by the stamp mills in the Black Hills, where they must economize water. They use 2,500 gallons per ton of ore. At the Rara Avis mine just enough water to carry the pulp over the plates was found to be all-sufficient. This mill, which has used the machine longest, is doing satisfactorily from 3 to 4 tons per hour, with but little wear.

There is no wear of note on any part of the mill except on the ball and shoe ring. The latter is made of rolled steel, and will wear for several months. The ball is made of the very best cold blast charcoal iron, deeply chilled, which gives it a degree of hardness not exceeded by the best tool steel. The wear on the ball is very slight; at the rate of 60 tons per day the ball will last from two to three months; in fact the total wear is not 20 per cent as much as on a stamp mill with an equal capacity. The amount of slimes made is but a very small percentage of that made by a stamp mill, and from the peculiar form of the pulp is more readily concentrated, as shown by actual workings on a very large scale.

The mill in its construction is very simple and easily set up. Any wearing part can be replaced in one hour. The lower half of each screen frame is supplied with a door, which is hung on hinges, so that it can be raised and the mill cleaned out while it is in operation, if necessary. It is not possible for rust gold to escape being brightened by the rubbing it receives while in the mill, and consequently caught.

All parts of the mill are made very exact by templates, which assures a fit when extras are required at the mines. Another great point in the mill is its very low speed and small power required. The large mill, which reduces 60 tons per day through a 60 mesh screen, and is really capable of doing much more, only requires 10 horse power, which drives it very easily, the speed of the shaft being but 190, while the ball makes about one-third less revolutions per minute.



TASKER'S IMPROVED THOMPSON PULVERIZER.

The Pit Dwellers of Yeso.

Professor John Milne, of Tokio, recently read before the Asiatic Society of Japan a paper on the pit dwellers of the Island of Yeso. According to the Aino accounts this race lived in huts built over holes, and knew the art of pottery. Mr. Milne found and examined pits on a small island near Nemuro, the northeast port of Yeso, and among the Kurile Islands. Near them were found flint arrow heads and fragments of earthenware. The Japanese say that the pits, which are rectangular in shape, were inhabited by a race of *Kohito*, or dwarfs, which was exterminated by the Ainos. In the extreme north of the Kuriles Mr. Milne met with the aborigines of these islands dwelling in huts built over pits, which were, in general appearance, identical with the pits found further south. In Saghalin and Kamschatka also, certain tribes dwell in pits. The general conclusion to which the writer comes is that the modern representatives of the pit dwellers are the Kurilsky, and some of the inhabitants of Saghalin and Kamschatka, who, like the Esquimo of the Atlantic seaboard, had in former times extended much further south.

Several facts were also adduced to show that the shell heaps of Japan were of Aino formation. Mr. Milne suggested that the hairy Ainos were connected with the hairy Papuans, who at one time extended from their present home in the south in a continuous line through the Philippines to Japan. Malay races invaded this line in the Philippines, so that all that remain of the aboriginal stock are the hairy Aeta. In Formosa, Oshima, Satsuma, and other parts of Japan, links of the hairy, large-eyed, round-faced Aino type are still to be found. The modern Japanese invaded the line from the direction of Corea, and as they exterminated or drove the Ainos toward the north, the Ainos in his turn pressed upon the pit dwellers, who retreated to more northern regions, leaving behind him, as indications of his former presence, the pit-like depressions found in so many parts of Yeso.

DRIED buffalo meat and tongues, to the extent of 9,000 pounds, which reached Springfield, Dakota, lately, was pronounced superior to dried beef.

Deleterious Effects of Boracic Acid.

Since Dumas showed for the first time, now nearly twenty years ago, that borax had, like carbolic acid and other antiseptics, the property of preventing fermentation, it has formed part of several antiseptic mixtures of salts proposed by various inventors for the preservation of meat, fruits, vegetables, etc. Boracic acid has likewise come in for its share of patronage in this respect, and lately Professor Barth has brought forward a mixture of glycerine and boracic acid, which, according to his experiments, possesses the power of preserving various perishable substances in a remarkable manner. The same may be said of *corrosive sublimate, arsenious acid*, and a quantity of other chemical products which we should be sorry to see used to preserve articles of diet in daily use. However small the quantity of these substances which may be used in order to exert the preservative effect, it is evident that by the daily consumption of substances so preserved, the animal economy absorbs in the long run a large amount, and in a longer or shorter interval the health is impaired.

Such, according to Mr. Gade, is the case with *boracic acid*, as he states in a letter to the *Times*, which is reproduced in the *British Medical Journal* and other periodicals. Mr. Gade, while residing in Sweden, used boracic acid to preserve the milk supplied to his household from decomposition. For some time no ill effects were noticed, but after using the milk for a short time two of his young children fell ill; they became languid and drowsy, and their appetite failed. This was at first attributed to the hot weather, during which the boracic acid had preserved the milk quite sweet and pure; but it was soon traced to this article of diet, and a physician who was called in had no doubt of it, the boracic acid acting, he said, as an anodyne. The *British Medical Journal*, in its comments on this, while admitting that "the action of boracic acid has not been much investigated," nevertheless boldly asserts that "it cannot be a poison of much strength," but as it is now a well known germicide, its effects on man cannot be inert.

Statistics of Woolen Manufactures.

The census statistics of woolen manufactures shows 2,684 establishments of all kinds, giving employment to 160,998 hands, who received in wages during the year $47,180,618. The value of materials used was $164,114,799, and the value of the products was $267,699,504. Classified, the products were: Woolen goods, including blankets, all sorts of woolen dress goods, woolen yarn, and woolen rolls, $160,606,721; carpets, other than rag, $31,792,892; felt goods, $3,619,653; worsted goods, $33,549,942; wool hats, $8,516,569; hosiery and knit goods, including those mixed with cotton, $28,613,727.

THERE have been imported into this city recently from Egypt 10,000 barrels of onions. This is said to be the first importation from that region; the gardens of the Bermudas and Portugal having hitherto supplied the deficiencies of our home fields. The Egyptian onions are said to keep better and longer than those of more western countries, giving them especial value in ship supplies for long voyages.

JOHN SCOTT RUSSELL.

The decease of this eminent engineer was recently announced in the SCIENTIFIC AMERICAN. We now give a portrait from the *Illustrated London News*. He died in June last, at Ventnor, in the Isle of Wight, in the seventy-fifth year of his age. He was born in the Vale of Clyde in the year 1808. On the death of Sir John Leslie, Professor of Natural Philosophy in Edinburgh, in 1832, Scott Russell, though then only twenty-four years of age, was elected to fill the vacancy temporarily. About this time he commenced his famous researches into the nature of waves, with the view to improving the forms of vessels. His first paper on this subject was read before the British Association in 1835. He discovered during these researches the existence of the wave of translation, and developed the wave line system of construction of ships, in connection with which his name is now so widely known.

The first vessel on the wave system was called the Wave, and was built in 1835. He succeeded in having his system employed in the construction of the new fleet of the West India Royal Mail Company, and four of the largest and fastest of these vessels—viz., the Teviot, the Tay, the Clyde, and the Tweed—were built and designed by himself.

Mr. Russell was for many years known as a shipbuilder on the Thames. The most important work he ever constructed was the Great Eastern steamship, which he contracted to build for a company of which the late Mr. Brunel was the engineer. The Great Eastern, whatever may have been her commercial failings, was undoubtedly a triumph of technical skill. She was built on the wave line system of shape, and was constructed on the longitudinal double skin principle, which also was invented by Mr. Russell. It is not necessary now to refer to this ship in any detail. In spite of the recent advances made in the size of vessels, the Great Eastern, which was built more than a quarter of a century ago, remains much the largest ship in existence, as also one of the strongest and lightest built in proportion to tonnage. The paddle engines and boilers of this vessel were also made and designed by Mr. Russell. He was one of the earliest and most active advocates of ironclad men-of-war.

In early life he took a great interest in steam locomotion on ordinary roads, and while at Greenock he constructed a steam coach which ran for some time successfully between Greenock and Paisley. The springs of this steam carriage, and the manner in which the machinery adapted itself to the inequalities of the road, were triumphs of ingenuity.

His greatest engineering work was without doubt the vast dome of the Vienna Exhibition of 1873. This dome is, among roofs, what the Great Eastern is to ships, its clear span of 360 feet being by far the largest in the world. It will be probably the most enduring monument of its designer's fame and ability.

JOHN SCOTT RUSSELL.

MICROSCOPICAL EXAMINATION OF ICE.

BY EPHRAIM CUTTER, NEW YORK, MEMBER PHILOSOPHICAL SOCIETY GREAT BRITAIN, ETC., ETC.

PRELUDE.

This paper is a report of an examination of the forms found in the water derived from the melting of ice used in domestic consumption. The subject is one that is interesting, because ice is an article of commerce, and is extensively consumed in this country.

Again, it is interesting as the notion prevails that water is purified by freezing, and hence can be used freely, even though it may come from ponds or lakes whose waters are impure. How far this notion is sustained by chemical examination is seen in the following extract:

"The notion that ice purifies itself by the process of freezing is not based upon trustworthy scientific observation. On the contrary, it is utterly wrong in principle to take the ice for consumption, from any pond the water of which is so fouled as to be unfit for drinking purposes."*

Again, how far the notion of ice purifying itself by freezing is sustained by a morphological (*morphos*, form, *logos*, account) examination may be gathered somewhat from what follows. I say "somewhat" advisedly, since the report simply relates to the specimens examined, and may be modified by subsequent examinations. So far as the results are positive, they are final as to the specimens examined, but not as to specimens not examined. Those must be judged by themselves. The examinations reported here are microscopical, and relate to objects not recognized by the unaided vision, which for distinction is now termed *macroscopic* (*macros*, large, and *scopein*, to view); this includes ordinary vision. Should any doubt, it is easy to test the statements by taking domestic ice sufficient to fill an ordinary ice pitcher which is clean. Melt and filter the water resulting through a bag made of fine twilled cotton, say three inches by one and one-half, and when the water is filtered down to the capacity of the bag, inverting the bag into a clean tumbler or goblet, then sopping it in the water in the goblet, and finally twisting the bag longitudinally.

The filtrate thus obtained will give to the naked eye an idea of the amount of dirt found; and if the quantity of dirt is like that obtained in the preparations for the following observations, some surprise will be excited and evidence afforded to sustain those who are accustomed to filter drinking water into jars or bottles, and to cool it indirectly by placing said jars of water into a refrigerator. Indeed, Dr. Cuzner, the artist, will testify that ice enough to fill a goblet has, when melted, produced foreign substances in quantities incontestably evident before the microscopical examination. Still, as will be seen in ice examined at Amherst, Mass., I found hardly any sediment. Hence, all ice is not to be pronounced impure, but rather the ground is to be taken that if some ice is quite free from dirt, the great ice companies should take pains to furnish only such ice for drinking purposes.*

There is no doubt that ice exposed to the air after it has been taken from the water, especially in summer time, attracts dirt. This is seen in the refrigerating apparatus of Mr. A. J. Chace, of Boston, who cools and purifies air by ice aspiration. Last summer the writer placed at Weehawken, N. J., near 42d Street pier ferry, a simple apparatus made of a common wooden water pail, with four half-inch holes bored in sides, two inches above the bottom; one inch higher was a shelf of oil cloth loosely fitted; on this was placed ice. The top was loosely covered with oil cloth. The rationale was that the ice as it melted cooled the air, which was displaced through the side holes; then warm air would enter the crevices at the top, and thus a current would be formed, which, carrying with it the bodies found in the air, would then lodge on the ice by its stickiness during melting.

In an exposure from 8 P.M. to 7 A.M. next day, the mass of ice nearly melted, and what was left was covered black with dirt; and the water from the melting was so loaded with sand and dirt, that I was unable to obtain the object of the aspiration, to wit, the detection of the so-called ague plants of the district. So it seems that ice conveyed in open carts on highways must attract more or less dirt that floats in the atmosphere, and may explain the superabundance of dirt in urban as compared with suburban ice.

It will be my aim to show what forms may have come from the water, and what from the air. When large cakes of ice are black with interstitial dirt frozen into its substance (as seen this summer on 8th Avenue), it needs no expert to point out presence. This report is intended to show something of the field for exploration that here is open to the student of food stuffs. It is not intended for alarm, nor for discredit of ice companies, for there is no doubt they use care and judgment in their business. Nor does it aim to exclude ice from use. It would simply try to regulate use by knowledge, so that exposure to filth may be avoided as much as possible.

FIRST EXAMINATION.

Ice said to be from Maine, from a New York ice company. It was soft, cloudy, spongy, light, opaque. Mode of examination: A clean bag, one half inch by four inches, made of cotton cloth, was tied to the escape pipe of a refrigerator—zinc lined, shelf at top—that had been washed and cleansed with filtered water. The filtrate of from thirty to forty pounds of ice was collected by inverting the detached bag into a clean goblet, then sopping the inverted bag in the filtrate, and wringing the bag also. Power of microscope, one-fifth inch objective. Eye piece, one inch and half inch, 350 diameters.

Fig. 1, drawn by Mr. Hotchkiss, from specimens: 1, Yeast; 2, bacteria; 3, pelomyxa; 4, difflugia; 5, yeast vegetating filaments; 6, mycelial filaments of red water fungus; 7, dark red organic unknown body; 8, trachelomonas; 9, astrionella formosa; 10, bast fibers; 11, ascus; 12, wool; 13, spherotheca fungus; 14, decaying leaf; 15, difflugia unusual; 16, monad; 17, silica; 18, carbon; 19, feather barb; 20, difflugia globosa; 21, epithelia; 22, starch of corn, wheat, and potato; 23, egg of bryozoa; 24, dirt, debris, etc.; 25, abundant mycelial filaments; 26, actinophrys sol; 27, aneurœa monostylus; 28, bacillaria diatom.; 29, chitin; 30, closterium; 31, cotton fiber; 32, diatoma vulgaris; 33, other diatomaceæ; 34, dinobryina sertularia; 35, eggs of entomostraca; 36, epidermis of wheat; 37, euglenia viridis; 38, gemiasma verdans; 39, hair of plants; 40, leaves of moss; 41, liber fibers; 42, lyngbya; 43, oscillatoria; 44, pediastrum boryanum; 45, other pelomyxas; 46, peridinium cinctum; 47, pitted ducts; 48, potato starch; 49, protococcus; 50, rotifer; 51, scenedesmus quad.; 52, skeleton of leaves; 53, silk; 54, spiral tissues of leaf; 55, transverse woody fiber. Thirty-three of these objects belong to fresh water, and twenty-two to air as a medium of communication. At my request, Dr. G. B. Harriman, of Boston, examined this filtrate, and found about two-thirds of the forms found in Boston ice by him, and reported farther on.

Fig. 1.—MICROSCOPICAL EXAMINATION OF ICE.

DESCRIPTION OF CUT. (FIG. 1.)

1. Yeast. This is the alcohol yeast of the yeast pot, torula cerevisiæ, the spores of which are everywhere present, ready to germinate if they have the opportunity. Its presence in ice is interesting.

2. Bacteria. These are minute self-moving protoplasmic bodies. Some regard them as ultimate forms of life; others that they are but the embryonal forms, seeds, or babies (as it were) of a vegetation, yet capable of immense reproduction by division, arranging themselves into masses, chains, etc., at will. In order to know what plants they belong to, culture is necessary. It is possible that those in the cut may be the spores or seeds of the yeast plants, but it cannot be said with certainty.

3. Pelomyxa. This means "mud mucus." It is an animal classed with the rhizopod or root-footed protoplasmic animals. They are very greedy, and eat much mud or dirt. The color in this case is dark amber, and may be mistaken for decaying vegetable matter. The writer regards them with suspicion, as contributing when dead and decaying to cause the "cucumber" and fish oil taste that sometimes occurs in hydrant drinking waters, notably the Cochituate.

4. These are portions of difflugia (Latin, *difluo*, to flow); these are like number 3, only they have the property of building over themselves a covering made of particles of sand glued together so as to protect their structural proto

* Seventh annual report, Massachusetts State Board of Health, 1876. Prof. A. H. Nichols, chemist, Massachusetts Institute Technology, Boston.

* Another very practical way to get information of this character is to inspect the bottom of an ice pitcher inside, after it has been used freely for drink.

plasmic bodies. Lately, the writer saw a difflugia cratera, whose shell had been broken on one side. The cilia that were usually seen at the natural opening were seen to be active at the artificial opening. The contour of the hole changed under view from circular to a narrower one, forming a segment of the first; showing an action of repair; suddenly there was a gush of protoplasmic jelly, and the animal was dead, dying in its efforts of reconstruction!

5. Yeast filaments, such as are seen in fluids where air has access.

6. Mycelial filaments of a red fungus, found commonly in Horn Pond, Woburn, Mass.; also at Cambridge. Name not known to writer.

7. Is a curious dark red tubular body, fragments of which I have often seen in hydrant drinking waters. Its fracture is glassy. It is an animal substance probably, and this is the best specimen I have seen.

8. Trachelomonas. These are by Ehrenberg claimed as infusoria. They are very abundant in hydrant waters at all seasons of the year. The specimen here is dead, but the living individual moves its curious long flagelliform filaments, by means of which it gracefully propels itself in any direction at will.

Fig. 2.

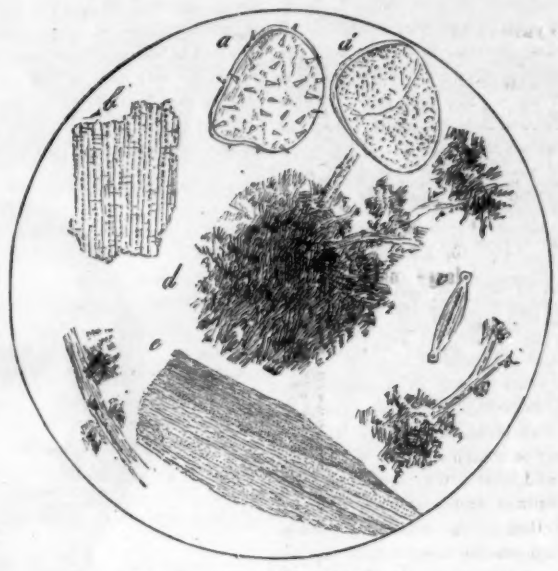


Fig. 3.—One inch objective.

9. Astrionella formosa. A beautiful, very common diatom, that arranges itself into forms like the spokes of a wheel. Three spokes only are here given; usually, twelve. This power of self-symmetrical arrangement is surprising and mysterious.

10. Bast or linen fiber. This probably came from some table cloth, towel, or clothing.

11. This may be an ascus or theca of a fungus, which is a part of a fructification of the fungus, and also found in lichens. It is strikingly well developed.

12. Wool fiber. Note the maceration at one end.

13. This is found in mildews.

14. Decaying leaf.

15. Probably a large difflugia.

16. An isolated infusoria; very common in hydrant water.

17. Piece of difflugia.

18. Charcoal, probably.

19. Feather barb.

20. A very small difflugia globosa.

21. Epithelia; probably animal. These are suspicious organisms. See New York *Medical Record*, April 8, 1882. They are parts of the investing covering of all portions of the human body, inside and out.

22. Starch grains: X, corn or maize; Y, potato; W, wheat.

23. This is the egg of a bryozoa or polyzoa, found not unfrequently in the drinking waters of our cities and towns. It corresponds to the "winter egg" of entomostraca. It forms one of the four modes of reproduction which Smith distinguishes: First, eggs from spermatozoa; second, from internal development (*this very one*); third, external buds; fourth, brown bodies in empty eggs. This particular egg is seen to have an oval opening, whence the contents have been hatched or destroyed. It has been traced to a single polyp. Usually, the animals live in a colony, and are met with in fresh water on stones, sticks, sides of flumes, and free. I have seen colonies of these bryozoa in masses as big as a bushel basket, hanging on and covering the perpendicular boards of a flume. In the present case, the egg is nearly as large as the animal in a state of rest. Its detection shows decidedly the presence of animal life in ice

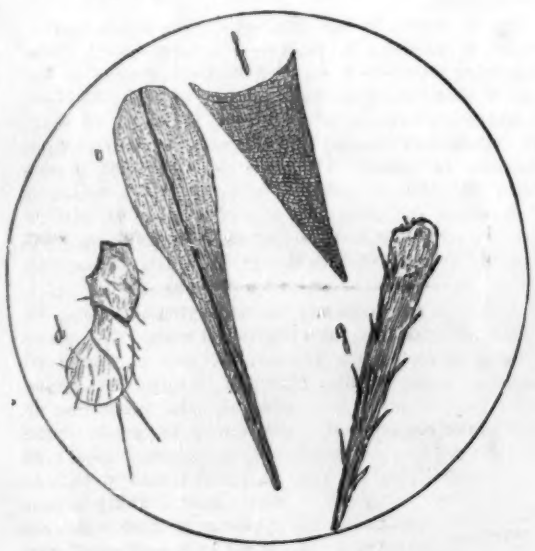


Fig. 4.

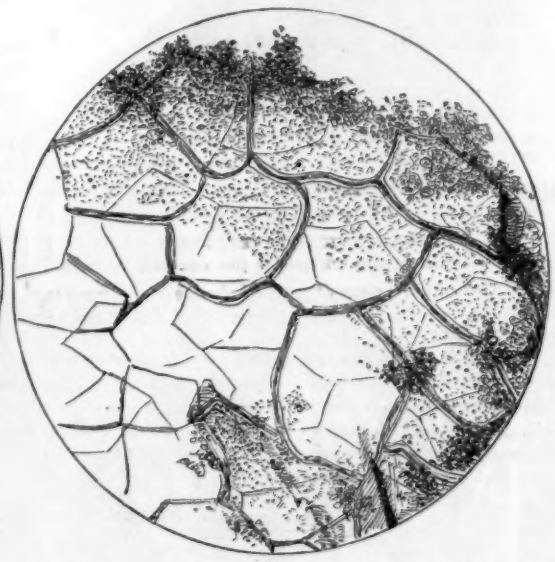


Fig. 5

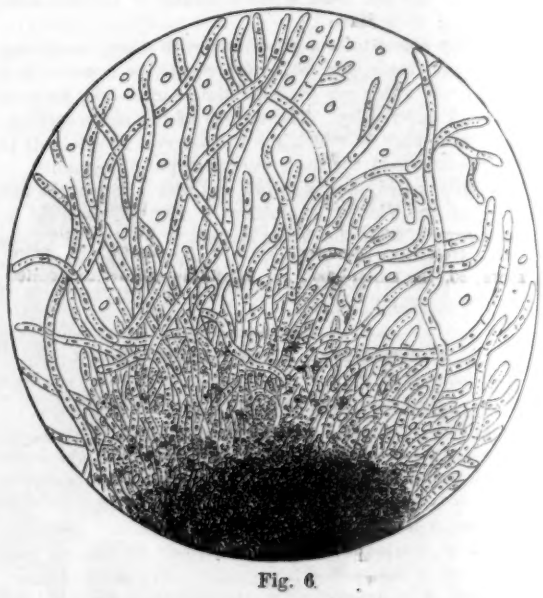


Fig. 6

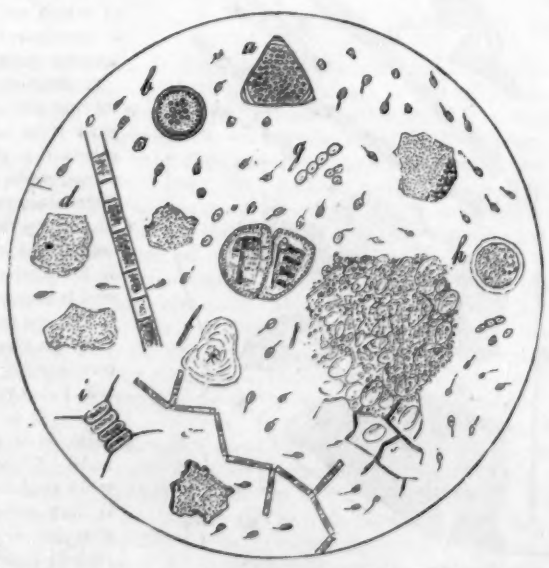


Fig. 7

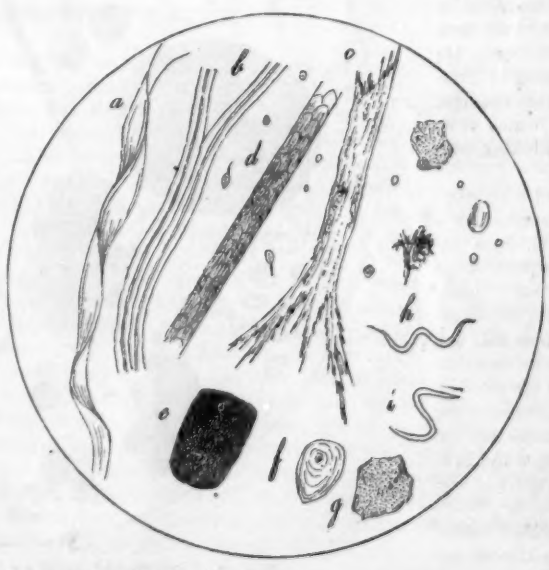


Fig. 8.

24. *Dirt.* This is hard to picture, but should have a place in this report, though it has been defined as "matter out of place."

Of the remaining thirty-one things named, six are animal or animal substances, the rest are vegetable or vegetable substances. They do not include the whole of objects found, as some could not be classified or named by the writer. It may be of interest to add that the melted filtered water from this specimen was quite black and dirty looking to the naked eye, and that the examination of this specimen shows impurities, both from bodies that float in, or are blown through the intervention of, the air; and, also, those found in the water of the ponds and lakes, and that are used for drinking purposes. So far as it goes, the examination favors the cooling of drinking water by indirect contact with ice as a cooling agent, or by setting the filtered water in a refrigerator. How far the things named are injurious has not yet been settled. It is a problem that may well attract the attention of those interested in the department of public medicine, though there is no doubt that drinking water is more potable without them.

SECOND EXAMINATION.

Ice from a New York Company. A common silver ice pitcher, porcelain lined, was cleaned with filtered Croton water and filled with broken ice, source unknown, clear, compact, solid, diaphanous, and pure looking. This was allowed to melt. One quart of water resulted, and was filtered as before, and examined with following results:

1, Bacteria; 2, bast fiber; 3, broken down tegument and substance of leaves; 4, coal; 5, closterium lunare, dead; 6, collection of liber fibers; 7, collection of mycelial filaments; 8, dirt abundant; 9, a desmid, penium; 10, difflugia globosa; 11, euglypha; 12, exuvium; 13, egg of the fresh water polyzoa above named, unhatched; 14, euglypha cristata; 15, foot stocks of vorticells, twenty-five in number; 16, fiber of wool, colored blue; 17, fungus filament; 18, gluten cells, wheat; 19, gromia, dead; 20, humus; 21, large paramecia; 22, leptothrix; 23, long vegetable hair; 24, linen fiber embedded in a mass of decaying vegetable substance; 25, large double body, probably eggs, but possibly vegetable; 26, nostoc; 27, membrum disjectum of a large entomostraca; 28, pelomyxa; 29, potato starch; 30, portion of a leaf with chlorophyl attached, color unchanged; 31, silica; 32, shell of a cyprus; 33, supposed egg of an entomostraca; 34, vorticell, dead; 35, vegetable hairs; 36, worm; 37, wheat starch; 38, yeast. Twenty of these objects are aquatic, the rest come by means of air.

THIRD EXAMINATION.

Same as preceding, with more ice of like kind. 1, Amœba; 2, bacteria; 3, corn starch; 4, cotton fiber; 5, chitin; 6, claw

of water spider; 7, dirt; 8, daphne claws; 9, epithelium, animal and vegetable; 10, gromia; 11, gemiasma; 12, humus; 13, linen fiber; 14, potato starch; 15, pelomyxa; 16, parenchyma of leaf; 17, portion of a red water fungus; 18, piece of a red cranberry skin; 19, protococcus, probably gemiasma; 20, silica; 21, silk fiber; 22, vegetable hair; 23, wheat starch; 24, wheat gluten cells; 25, yeast. Ten of these objects come from water.

FOURTH EXAMINATION.

G. B. Harriman, D.D.S., of Boston, Mass., my associate, reports as found in the melted water of one cake of ice, Boston Highlands: 1, acanthodinium, with clusters of twelve spiral cells separated in all directions; 2, botridium cells; 3, closterium; 4, chlorococcus; 5, cotton fiber; 6, cryptomonas lenticularis; 7, claws of insects; 8, decaying leaves; 9, dust and excrementitious matters; 10, difflugia, dead, several varieties; 11, daphne claws; 12, epithelial scales, human; 13, fish scales, 14, fungi and spores; 15, humus; 16, hairs of various animals; 17, linen fiber; 18, large masses of decaying vegetable substances; 19, navicula; 20, nebalia; 21, peridinium cinctum; 22, peredinium spiniferum; 23, starch; 24, vorticella, two joined together; 25, wood fiber of various kinds; 26, yeast.

FIFTH EXAMINATION.

Ice from Amherst, Mass., furnished by Mr. C. H. Kellogg. Specimen taken from his cream cooler, and thoroughly washed. This showed but little morphological impurity beyond epithelia, animal and vegetable. From statements made by Mr. Kellogg, this ice was probably chemically contaminated by a paper mill.

SIXTH EXAMINATION.

Ice from Horn Pond, Woburn, Mass. This presented considerable lightish colored deposit, in which a few animal and vegetable forms were found, but was mainly made up of epithelia and amorphous dirt. The result was unexpected, as unfiltered Horn Pond water is rich in forms of life.

SEVENTH EXAMINATION.

Ice from New Haven, Conn. This specimen was quite free from forms of life.

EIGHTH EXAMINATION.

Ice from a provision store, July 13. 1, Amœba, alive; 2, bacteria; 3, cœlastrum sphericum; 4, chlorococcus; 5, diatoma vulgaris; 6, epithelia; 7, linen fiber; 8, monads; 9, monostylus aneurœa; 10, mass of carbon; 11, nostoc; 12, one gonidia of cœlastrum sphericum; 13, protococcus; 14, scenedesmus obliquus; 15, scenedesmus quadricauda; 16, starch grain; 17, staurastrum; 18, tabellaria; 19, tetrospore; 20, trachelomonas; 21, vegetable epithelium collection; 22, young closterium.

FIGURE 2.

Forms found in ice used in New York. Drawn by Dr. A. T. Cuzner, Peekskill.

a. Tabellaria.—A diatom found commonly in all surface drinking water. They have the power to arrange in rows, and the specimen in the cut has fifteen individuals in one aggregation, which is a small one. Diatoms are regarded as plants by the majority of observers. A good deal of difficulty arises from trying to measure things with the lines and plummets of past time, when the things in question were absolutely unknown, and hence could not be properly named at the date when the word "plant" was invented. As knowledge increases names must be changed. The diatoms are generally regarded as innocent, though some observers take the opposite ground.

b. Epithelia. These are probably human, washed into the water and frozen into the ice. They are constantly thrown off in washing, sputa, and the excretions of the body. They are also found on all other vertebrate animals and on vegetables.

c. Is spiral tissue from some leaf, probably.

d. Is a gromia—a rhizopod—animal.

e. Is potato starch more highly magnified than in Fig. 1. It is somewhat remarkable how long a time starch will exist unchanged in shape and form in pond waters.

f. Wheat starch cooked.

g. Wheat starch uncooked.

h. corn starch.

i. Yeast.

j. Bacilli, vibriones, bacteria.

k. Astrionella formosa.

l. Monad.

m. Three algæ ranged side by side, green chlorophyl collected at extremities.

n. Chitin.

o. Sporangia fungus.

p and *q.* Pelomyxas.

FIGURE 3.—(CUZNER).

Forms found in ice water, New York.

a, a'. Carapaces of entomostraca.

b. Tegument of wheat.

c. Synhedra, a diatom.

d. Mass of dirt, *débris*, etc.

e. Leaf of moss.

The other objects are portions of decayed leaves.

FIGURE 4.—(CUZNER).

One inch objective. Ice water forms.

d. Portion of limb from a water spider.

e. A sphagnum leaf entire.

f. Portion of another sphagnum (moss), leaf with reticulation shown.

g. Spined vegetable tissue.

FIGURE 5.

Portion of tree leaf with parenchymatous chlorophyl. This was drawn from a solar projection by Dr. Cuzner. It shows how the process of decay was averted by freezing.

FIGURE 6.—(CUZNER).

Mycelial filaments of a vinegar yeast found in connection with melting ice. At the bottom are the embryonal spores of the yeast.

This shows what happens when ice water is allowed to stand exposed to the action of the air. A long, dirty, grayish, gelatinous ribbon, half an inch wide and about one-eighth inch thick, appeared to be a mass of what is called "the mother of vinegar." The cut gives the appearances under the microscope. The significance shows what is the full development of some of the embryonal forms of life found in ice water when subjected to conditions that are present in refrigerators.

FIGURE 7.—(CUZNER).

Forms from Boston ice. (Not from Dr. Harriman's specimen.)

a. Epilobium montanum—pollen.

b. Diatom.

c. Melosira.

d. Pavement epithelia. Five specimens.

e. Diatom vulgare.

f. Starch.

g. Alcohol yeast

h. Protococcus.

i. Scenedesmus quadricauda.

j. Parenchyma of wheat.

The numerous objects in this field are monads that developed in large numbers in the specimen kept for a few days, as might be expected.

FIGURE 8.—(CUZNER).

Objects found in ice water.

a. Cotton fiber.

b. Silk fibers.

c. Bast fiber frayed by maceration.

d. Wool.

e. Pelomyxa.

f. Starch. (This is common.)

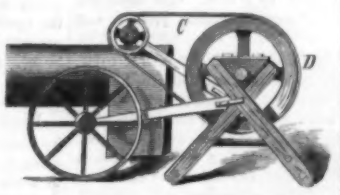
g. Epithelia pavement.

h, i. Curious algæ, sometimes crooked like an oxhorn, allied to ankistrodesmus falcatus.

MECHANICAL INVENTIONS.

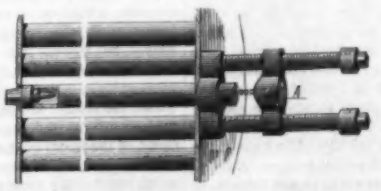
Motor and Thrasher Connection.

We give an engraving of a novel device for connecting motors and thrashers, which consists of a jack, tumbling rod, and belt, so arranged that the motor may be placed at any desired distance from the thrasher and a short belt may be used. C is a jack formed of two X-shaped side frames connected by rounds, and having bearings secured in their upper angles in which the journals of the wheel, D, revolve. Around this wheel passes a belt which also passes around the band wheel of the engine. The jack is supported against the pull of the belt by two braces, the ends of which rest in the side angles of the frame. The outer end of one of the braces rests against the bearings of the band wheel, and the outer end of the other rests against the rear wheel of the engine. These braces form all the support that the jack needs. One of the journals of the wheel, D, projects toward and is squared to fit into the square socket of a tumbling rod, that is connected at its other end to the journal of a thrashing cylinder. This device has been patented by Mr. Cyrus Stine, of McVeytown, Pa.



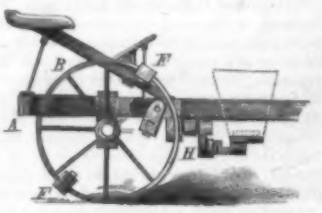
Apparatus for Drawing and Replacing Boiler Tubes.

The removal of a defective flue from a boiler is a laborious operation when the appliances generally employed are used. Messrs. Lorenzo W. Denney and Albert C. Johnson, of Wilmington, Del., have lately patented a device by which the labor and time employed for this purpose are materially lessened; the device is shown in the annexed cut. A is a yoke having a central aperture that passes freely over a boiler tube, and through the sides of which a set screw is tapped. Screws are fitted through threaded apertures in the ends of the yoke, A, upon which are formed squared heads by which the screws are turned. At the lower ends of the screws is a block having a central aperture corresponding to the aperture in yoke, A, and is formed with steps for receiving the ends of the screws. A starting plug that enters the tubes and has a shoulder to take against their ends, also has a hole at its smaller end for connecting a chain that will pass through the tube and be secured to the yoke, A. In use the block at the end of the screws is placed against the boiler head, with its aperture over the tube to be drawn, a chain from the yoke, A, is passed through the tube and secured to the starting plug, and the screws being turned, the tube is started, and when it is drawn far enough to receive the yoke, A, the chain and plug are removed and the yoke clamped to the tube by the set screw, and the screws operated as before. This operation is reversed to replace a tube.



Seed Planter.

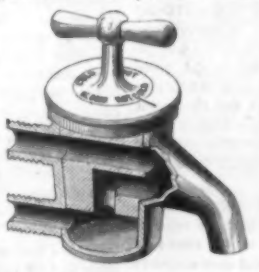
Mr. John W. Bunch, of Commercial Point, O., has patented a simple and effective mechanism for operating the seed dropping slide of a planter from the transporting wheels, and also to hold the wheels from revolving when turning and when adjusting the machine to bring the cross rows in line. In the accompanying cut, A is the frame of an ordinary seed planter, and B the transporting wheels, which are rigidly secured to the axle of the planter, the wheels carrying the axle in their revolution. The axle revolves in bearings in blocks adjustably secured to the side bars of the frame, A, by bolts. To the rim of each wheel are firmly attached directly opposite to each other, blocks, F, that are designed to mark the hills and operate the seed dropping mechanism. The inner end of one block of each wheel is rounded and secured to the wheels in such positions that when the block with a rounded end of one wheel is in contact with the ground the corresponding block of the other wheel will be at its top. To the lower side of a cross bar of the frame, A, is pivoted a bar, on the ends of which are cranks, H. The rear arms of the cranks are in such positions that they will be struck successively by the rounded ends of the blocks, F. The forward ends of the cranks are connected in such a manner to the seed dropping slide by this construction that when they are struck successively by the rounded blocks, F, the dropping slide will be moved so that seed will be dropped at each half revolution of the wheels. By a lever under the control of the driver, the wheels are prevented from revolving when turning around at the ends of the rows.



MISCELLANEOUS INVENTIONS.

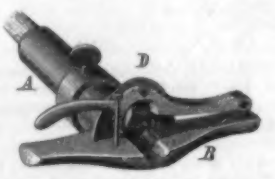
Hot and Cold Water Faucet.

Mr. John H. Seabury, of Hempstead, N. Y., has recently patented a simple and efficient water faucet, from which hot or cold water may be drawn separately, or both may be drawn at the same time. The barrel of the faucet is made tapering, to form a seat for the plug, which is held in the ordinary way. The plug has the usual handle, and has also a dial on the plug for indicating the character of the water discharged, that is, hot, cold, hot and cold, and for indicating when the faucet is closed. The barrel is provided at one side with inlet openings for hot and cold water, that are connected respectively with suitable supply pipes, and at the opposite side is an elongated general delivery passage to the inner end of the discharge nozzle, which is correspondingly elongated. The plug is made with a transverse passage through it to connect the cold water inlet with the nozzle, and it also has a passage having three terminal openings that correspond with marks on the dial for the hot water. This faucet is readily operated to deliver either hot or cold water, or both at a time, and with the taper form of the plug and its seat, may readily be kept tight, and the passages in the plug being mainly transverse are easily made.



Billiard Cue Cutter.

Mr. Patrick Ryan, of New York city, has patented a new device for making a true cut on the ends of billiard cues. In the accompanying engraving A, is a sleeve provided with a clamping screw, and it also has a flange on its forward end. B is a stock that is swiveled to the sleeve and carries a hinged knife, and a recess in front of the opening in the sleeve, A, forms a continuous passage through the shell to the outer edge of the stock. D is a knife arm secured upon the stock and channeled to inclose the neck of the shell. The upward movement of the knife-arm is limited by a stop, and the face of the block is made square and forms an abutment and guide, so that the knife will always move in a plane exactly at right angles to the sleeve, A, in which the cue is placed and securely held for trimming.



ENGINEERING INVENTIONS.

A cheap and efficient device for expanding the ends of boiler tubes has been patented by Messrs. Joseph T. & William H. H. Griscom, of Nashville, Tenn. Rollers reduced in size to form a head at the end are held in radial slots in circular plates, and can be moved out or in radially from the central opening, which passes entirely through the expander. The rollers being inserted in the tube to be expanded, a tapering mandrel is passed through the central opening of the expander, and is operated by a hand lever for turning the device around in the end of the tube and expanding it.

An ingenious car coupling has been patented by Mr. Leander King, of Georgetown, O. The draw bar and draw head are attached to the car in the usual way. The coupling pin is connected by a pin to a clevis hinged to the top bar of a stirrup, and the side bars of the stirrup are hinged near their upper ends to a rod which works in bearings on the end of the car body, the stirrup and coupling pin being raised and lowered by turning the rod. The lower ends of the side bars of the stirrup are pivoted to the inner ends of bars which are hinged to the under side of the timbers that support the drawhead. Their outer ends are beveled and supported on an inclined plate that guides the coupling link into the mouth of the drawhead.

A novel car coupling has been patented by Mr. Ferdinand J. Blanke, of Whitewater, Wis. In the drawhead of the car is a clutch composed of two arms, having central projections through which an ordinary coupling pin passes, pivoting them and forming the connecting clutch. Between their rear ends is a spring that throws them apart and closes the front ends. The front end of each arm is in the form of a catch, one arm having a projection that corresponds with an opening in the other. In practice, the clutch is inserted in one drawhead and a coupling pin of the usual construction is inserted in the drawhead of the car to be coupled, and the cars are closed together, when the front ends of the clutch will be opened by the coupling pin of the car to be coupled, and after the heads pass the pin they are closed by the springs at their ends.

A machine of novel construction for grinding and pulverizing rock has lately been patented by Mr. Jacob Hause, of Chewsville, Md. The outer faces of the ends of the frame of the machine have bearings for the shafts of the rolls. There are grooved rolls in the upper part of the frame for crushing the larger lumps of stone, and below these are rolls with smooth surfaces for pulverizing the material. The shafts of all the rolls are horizontal. The axes of two crushing and two pulverizing rolls are in the same vertical plane, and the axes of one crushing roll and two of the pulverizing rollers on one side of the machine are in the same vertical plane. Each roll on one side is arranged to work against two rolls on the opposite side of the machine, so as to increase the crushing and pulverizing effect.

MECHANICAL INVENTIONS.

A hinge by which gates or doors are closed automatically from either direction has been patented by Mr Ezra Ale, of Altoona, Pa. A plate adapted to be attached to a door frame has two jaws projecting from its flat surface, and between these is passed a corresponding jaw that is attached to the edge of a hinge plate made to receive the edge of a door. A pintle passes through the jaws to form a hinge. A tubular casing projects from the rear surface of the hinge plate on the door frame, and contains a spiral spring, one end of which rests against the hinge plate, and to the other end is attached an eye bolt. To the eye of the bolt is secured the ends of chains that pass out through a transverse slot in the hinge plate and are secured to the sides of the opposing hinge. When the door is moved either way the spring is compressed, and if the door is released the spring closes it.

Mr. Hiram McIlroy, of Poplar Ridge, N. Y., has patented an invention by which the runners of bob sleighs adapt themselves to an uneven roadway. The sides of the sleighs are separate and are secured to the outer ends of tubes, and between the tubes and the raves of the sleigh are bearing blocks, the whole being connected and held by a clip. The tubes of each bob are held in place by a rod which passes through them and has nuts at each end. This rod also passes through lugs on the bolster plate, and is strengthened by braces that extend from its center to the forward ends of the raves. To the rear ends of blocks placed on top of and at right angles to the bolsters, half elliptic springs are attached at their centers, while their ends rest on the rear ends of the raves to hold the sleighs flat to the ground. At the rear sleigh the box rests on these blocks at the forward sleigh on a fifth wheel placed on the blocks.

AGRICULTURAL INVENTIONS.

Shears specially adapted for cutting or picking grapes and flowers have been patented by Mr. John Sager, of Thamesville, Can. The jaws of the shears are made concave on their cutting edges, and upon the pivot which joins the parts together is placed a finger which extends along and a little below the cutting edge of the lower jaw. This finger has a spring extension along the arm of the jaw and is riveted to it. The edge of the finger is made flat, as is also the edge of the opposing blade. The blade with the finger forms a clamping device, by which the grapes or flowers, after being severed, will be firmly held.

A corn planter which insures the planting of the hills at uniform distances, whether the ground is uneven or level, has been patented by Mr. Alfred A. McIntosh, of Lincoln, Neb. The frame, channel opening runners, seed boxes, and dropping slides, are of the usual construction. To the ends of an axle are secured wheels made with eight spokes, and to the outer ends of the spokes are attached cross-heads to mark the ground, and spikes to revolve the wheels and axle. By a suitably arranged system of cams and levers, in connection with the wheels and axle, the seed dropping devices placed over the rear of the channel runners are operated. The spokes of the wheels are made adjustable in their length to make the wheels larger and increase the distance between the hills.

An improved sulky cultivator has been patented by John W. Rockafellow, of Stockton, N. J. The cultivator axle is bent in U form, and to its center the tongue is attached. The lower ends of the axle are bent to the rearward, so that the cultivator balances on its wheels, when the plows are raised from the ground. Triangular frames, resting at their lower ends on the ground, are suspended from the axle and tongue by rods, and regulate the plows for depth of work. To these frames the forward parts of the plow beams are rigidly attached, and on the upper side of the frames are crosshead plates, to which auxiliary plow beams are attached, that may be adjusted laterally. The plow frame may be raised and attached to the rear end of the tongue to support the plows from the ground in turning or passing from place to place.

MISCELLANEOUS INVENTIONS.

Mr. Frank T. Knauss, of Scranton, Pa., has patented an improved device for attaching the legs of tables to their frames. The rails of the table are attached to a metallic corner piece by bolts or screws, and the leg of the table is secured to the corner piece by a bolt which passes through the corner piece and leg, and receives a thumb nut on its inner end. The leg is slotted in its upper end so as to be slipped upon the bolt without entirely removing the nut from the bolt. The corner piece will be cast with a lug which enters the slot when the leg is in place and holds it steady.

Mr. George P. Cole, of Johnstown, N. Y., has recently patented an improved manner of attaching sweat pads to horse collars. In the usual method of securing pads to collars, by stitching through the pad, and the thin web between the rim and the body of the collar, the thread soon rots and leaves the pad loose. The inventor cords the edge of the pad with wire, and inserts back of the wire, wire staples, which are passed through the thin web of the collar, and clinched at their ends, securing them firmly. The upper end of the wire is also passed through the collar and clinched, and on its lower end a loop is formed through which a staple is passed to secure it to the collar.

A simple and effective fire escape has been patented by Mr. Frank P. Fish, of New York city. It is a ladder made of two semi-cylindrical sides, hinged together by suitable rods, and extending from near the ground to the cornice of the building. One of the pieces is secured to the wall by staples, and the other is left free to swing outward upon the hinged rounds. For folding the ladder a small wire cable is attached to the top of the movable side and extends over a pulley, and has secured to its outer end a counter balance weight. The cable is placed so that it may be reached from every story to release the movable ladder, and it is provided with projections that strike the levers of alarm bells at every story as it is carried up by the fall of the ladder. The ladder is held in position by suitable devices when it is closed.

Mr. Henry A. Tobey, of Dayton, O., has patented a register for air flues that prevents liquid and solid filth from being thrown into the flue. The bottom of the register inclines upward from its forward edge, so that any fluid thrown into it will flow out at the front. The back of the register is formed of slats, secured to its side walls, each upper slat being further forward than the preceding one, and overlap each other at such a distance apart that they may be easily cleaned. With this construction it will be impossible for filth to get from the register to the air flue. The front of the register is closed by a gate, secured by a lock. This register is especially designed for insane asylums, prisons, and infirmaries.

Mr. Phillip Hufeland, of New York city, has recently patented an elastic metal clasp for holding the covers of an album closed. A bent plate is fastened on the edge of the cover of an album, and to this plate a rod is pivoted that is provided with two tubular projections open at their outer ends. A U-shaped loop is surrounded by a coiled spring, and the ends of the spring are passed into the tubular projections and soldered, forming a bow or loop. When the album is closed the outer end of the loop formed by the spiral spring is drawn outward, and the spring is stretched, permitting it to pass over a headed stud on the opposite cover, and when the spring is released it presses against the stud and locks the two covers of the album.

Mr. William H. Hill, of New York city, has patented a combined horse collar and breast band, the breast band being attached to and extending down from the ends of the collar, so as to fit tightly against the animal's breast, and is provided at its ends with trace buckles and loops, and near its top with terrets for the reins. The breast-band is cut in such a manner that it inclines downward slightly from the ends of the collar, and fits close to the breast. It will not chafe or cut as a straight band does, and with this device the strain is distributed equally over the collar and the pad.

An improvement in corkscrews has been patented by Mr. Harry L. Perryman, of Lincoln, Neb. To the middle of the handle is attached a tube that has longitudinal slots opposite each other. Near the upper end of the shank of the corkscrew are studs fitting in the slots of the tube and guiding it in its reciprocations on the shank, and also acting as stops in its upward and downward movement. In use the screw is inserted into the cork and the handle pressed down, when a rapid pull is given to the handle, and the tube moves up the shank until the studs strike the lower end of the slots, imparting a sudden jerk to the screw and cork.

Mr. Elias Edwards, of Remus, Miss., has lately patented an improvement in four wheeled velocipedes. The vehicle has the usual wheels, axles, and springs, and upon the springs there is a cross bar upon which are placed the ends of curved parallel side pieces extending beyond the bars and held together at their forward ends by a crosspiece. In this cross piece, and in that portion of the reach in front of the forward axle, is journaled a vertical shaft to which is secured suitable gearing and a lever which reaches back to the rider's knees, for guiding the vehicle. The hubs of the rear wheels have ratchets and pawls secured to them, and rocking levers carry the pawls to propel the vehicle forward. The vehicle may be propelled either by the hands or feet alone, or by both hands and feet. By a peculiar arrangement rods attached to the spokes are forced down to engage with the earth and prevent any slipping of wheels.

A device for cutting button holes of different sizes has recently been patented by Messrs. Charles C. B. Carlton and Heman W. Clapp, both of Springfield, Mass. The device consists of a revolving plate, having on its periphery a number of cutting blades of different width, and in its center a hole for a pivot upon which it revolves between the branches of a forked shank, to which is attached a suitable handle. To the shank near the handle is secured one end of a flat spring, the other end of which is provided with a stud that works through a hole in a branch of the forked shank, and a spring catch engages with a series of holes in the revolving plate. A lever attached to the shank raises the spring and stud to allow the plate to revolve.

A ladder adapted to be used as an extension or step ladder has been patented by Mr. Winfield S. Thomas, of East Dixfield, Me. The ladder is of the usual construction of side pieces and rounds, and is made in two sections, the side pieces converging to a point at the top. A spike is inserted in the end of the top section, for better security when this section is used as brace for the lower section. The top section is pivoted at its lower ends to the lower section by a rod on which it turns when shifted from the extension to the step ladder. Notches are made in the upper ends of the side bars of the bottom section into which a rod, that passes through the lower part of the top section, drops and forms a locking device when the parts are connected for an extension ladder. To one of the side bars of the lower section an adjustable extension foot is attached for use upon uneven ground.

An invention that provides a means for protecting the bristles of hair, bath, and other brushes from injury by water, has been patented by Mr. Louis Yvon, of Brooklyn, N. Y. The stock of the brush has rows of holes bored in it to receive the bristles, and in the back of the stock, in line with the holes, are grooves to receive wires by which the bristles are drawn into and fastened in the holes, the wires and the bends of the bristles being below the surface of the back of the brush. Small metal bars that fit snugly are pressed into these grooves, after which the back of the brush is finished in the usual manner.

A vehicle spring composed of three parts, and made in such a manner as to preserve the elasticity of each, has been patented by Mr. Lafayette A. Melburn, of Denver, Col. The side bars of a buggy are secured to the front head block, and the rear axle and the ends of the spring are secured to them, the body of the buggy being supported upon the convex middle portion of the spring. The middle part of the spring corresponds in shape to the common half spring, while the two outer parts are constructed with a cylindrical bearing to form a joint with the downward curved end of the middle part. From the joint they are curved outward in nearly circular form and then inward underneath the side bars to which they are secured by clip.

An improvement in axles for wagons and other wheeled vehicles has been patented by Mr. Robert F. Ivey, of Cuthbert, Ga. To the underside of the ends of an axletree are adjustably secured metallic boxes made self-oiling by means of apertures, leading from their sides to their centers. Spindles are fitted to each of these boxes, that are a little more than double the length of the boxes, and are of uniform size and diameter throughout except at their center, which is formed with a collar, and their ends, which are reduced to receive nuts. The nuts on the outer ends of the spindles hold the wheels fast. The nuts on the opposite end hold the spindles to their places in the boxes. By this construction the wheels are stronger, and the spindles will not wear flat, and the boxes are always accessible and self-oiling.

Improvements in farm gates that move longitudinally across the roadway, and are operated by cords, have been patented by Mr. William C. Hooker, of Abingdon, Ill. The gate is of the ordinary construction, the top bar being extended to the rearward, and beneath it a parallel bar is placed, the two being connected at their rear ends by a cross bar. The gate moves back and forth between posts, to which, upon both sides of the gate, are attached bars corresponding with the extension bars of the gate. Two flanged rollers are placed loosely between the bars of the gate and the corresponding bars, and are journaled in the forked ends of a connecting bar. Upon the upper edge of the forward end of the track bars are double inclined projections, and upon the lower edges of upper bars are corresponding recesses. When the cord attached to the gate is pulled the gate is drawn back, the double incline and the momentum causing it to move on after the cord is released.

Mr. David W. Smith, of Port Townsend, W.T., has recently patented a fire and water proof safe that will float from the vessel should the vessel sink. The inner safe for containing valuables is rectangular in form, and is made burglar proof. Fastenings are secured to its outer surface by which a jacket of sufficient buoyancy to float the safe is attached, and the door has a water-tight packing. The buoyant jacket has a door opposite the door of the safe, that is secured when closed by any ordinary device. The safe is placed in an iron box on the deck of the vessel, and should the vessel sink it would float out of the box and not be carried down. A sheet metal buoy extends above the safe, and is painted with bright colors, designed to attract attention when the safe is in the water.

Improvements in car axles and wheels have been patented by Mr. William S. Pendleton, of Fort Worth, Tex. The inventor provides each end of the car axle with a fixed ratchet wheel, and the car wheels with spring pawls that engage with the ratchets. The car wheels are placed loosely upon the axle, and when rounding curves the wheel upon the outside of the curve will not be retarded by the slower motion of the inner wheel, the ratchet and pawl mechanism permitting the axle to turn in the inner wheel to accommodate the speed of the wheel on the outside of the curve. When the car is running in a straight line the wheels and axle move together the same as the usual construction.

An improvement in water tuyeres has been patented by Mr. Frederick Bowen, of Barnhart's Mills, Pa. The tuyere consists of two pipes coiled parallel to each other, forming a double coil. The water enters the pipes at one side of the tuyere and is discharged at the other. The tuyere is made tapering toward the front end; the pipes are arranged close together, and the rear end is surrounded by a band which holds the pipes together. With this construction the water passes through a shorter length of pipe, which is cooled much better, depositing less sediment, avoiding one of the causes of the destruction of the pipes.

Mr. Julius Leede, of Washington, D. C., has recently patented an improved water meter that is operated solely by the buoyancy of the water. The meter is placed at the highest point in the building where water is to be distributed, and the service pipe is carried directly up to it and connects with the primary distributing chamber. Two measuring chambers, into which the water flows from the distributing chamber, are formed by dividing the main portion of the meter casing by a vertical partition, which also serves as a support and guide for all the movable parts of the meter except the floats. Each of these chambers contains a float attached to an oscillating lever that operates the valves and registering mechanisms. Below the meter casing and attached to it is a governing cylinder containing a float, whose action controls the induction of water into the distributing chamber. When the discharge of water from the governing cylinder is arrested the accumulation of water in this cylinder will cause the float to rise and cut off the supply to the measuring cylinders.

An improvement in traction engines that adapts them to passing over uneven earth roads has been patented by Mr. Abraham O. Frick, of Waynesboro, Pa. The engine has two traction wheels, one loose on the axle and the other rigidly connected to it. The countershaft receives its motion from a pinion on the crankshaft, and the outer end is so constructed as to move at right angles to its axis, and also to move vertically, and is connected by means of compensating gear to transmit motion to either one or both of the traction wheels, and enabling them to have an independent motion in turning. The compensating gear wheel has a laterally flexible rim of teeth that serves to compensate for variations caused from the pitching of the engine from side to side.

An improved automatic car coupling has recently been patented by Mr. Carl G. A. Alexander, of Aldin, Iowa. The drawhead of the car has the usual central opening. The inner end of a coupling hook is pivoted in the bottom of the opening by a pin, the hooked end projecting beyond the drawhead to engage with the ordinary coupling pin of the opposite drawhead. On the rear face of the hook is a horizontal rack bar, the teeth of which engage with a pinion that is fast on the end of a vertical shaft revolving in an opening in the drawhead, and extends to the top of the car, where it is provided with a hand wheel, and a ratchet wheel and pawl. A spring is secured in the opening that tends to move the coupling bar inwardly. When the cars are run together the ends of the hooks pass over the coupling pins and are coupled, and to uncouple, the hand wheel at top of the car is turned and the hook drawn back, leaving the cars free to separate.

A novel device for raising objects from the ground to a wagon has been patented by Mr. Adam Borns, of Grand Rapids, Mich. Two rack standards secured in a base frame are provided on their edges with upwardly projecting teeth and united at the top by a transverse beam. A load carrying platform is provided with pawls that engage with the racks, and also with guide boxes sliding on each of the rack standards and from the top of the guide boxes, ropes pass over pulleys at the tops of the standards, having attached to their outer ends weights a little heavier than the weight of the platform. The pawls are provided with arms that hold them in their place, and a rope secured below the platform releases the pawls. An object to be raised is placed on the platform, when the platform is rocked from one side to the other, the pawls engaging with the teeth on the rack bars and raising the load.

Mr. Henry M. Loud, of Oscoda, Mich., has patented a novel device for feeding and turning logs in sawmills. The logs are placed on inclined skids having stop projections, which prevent them from rolling on the saw carriage. Just below these projections is a horizontal shaft provided with arms that lift the lowest log over the projection and on to the carriage, when the shaft revolves. For the purpose of turning the log when necessary a cant bar is provided that is operated by a chain and pulley from the shaft that furnishes power for the log lifting device. These devices are controlled by a lever so placed that when it is thrown in one direction it operates the log lifting devices, and thrown in the opposite direction it operates the log turning device.

A device by which the handle of a pump may be easily changed from one side to another has been patented by Mr. James Preston, of New York city. The pump cylinder is held to a frame provided with concave projections on its face by means of a U-shaped band that passes around the cylinder under a collar on its surface, and is bolted at its ends to the frame. The cylinder is thus free to turn on its axis, so that the spout can project in any desired direction. A connecting rod is pivoted at its lower end at the center line of the frame, and at its upper end to the pump handle near the upper end. The upper end of the handle is pivoted to the piston rod. If the pump is to be reversed the upper end of the connecting rod is detached from the handle and the handle is turned to the other side of the cylinder, when the rod is again attached to it.

An improved platform elevator has been patented by Mr. Thomas Keith, of New York city. It has the usual side frame, top bar, and bottom platform. A rocking platform having a double inclined floor is pivoted to the side frames, and is provided with a latch piece and spring to hold it in position to receive freight, and a lever to move it from one position to another. Tripping dogs come in contact with the latch piece and the edge of the rocking platform, when the elevator reaches the floor for which they are set, and the platform is pressed down and the freight discharged. Suitable devices are provided for starting and stopping the elevator at such points as may be desired.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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For Mill Mach'y & Mill Furnishing, see illus. adv. p.44.

Steam Pumps. See adv. Smith, Valle & Co., p. 46.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 28.

The Berryman Feed Water Heater and Purifier and Feed Pump. I. B. Davis' Patent. See illus. adv., p. 29.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 28.

Bostwick's Giant Riding Saw Machine, adv., page 28.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 29.

4 to 40 H P. Steam Engines. See adv. p. 28.

Pure Water furnished Cities, Paper Mills, Laundries, Steam Boilers, etc., by the Multifold System of the Newark Filtering Co., 177 Commerce St., Newark, N. J.

Red Jacket Adjustable Force Pump. See adv., p. 13.

Malleable and *Fine* Gray Iron Castings to order, by Capital City Malleable Iron Co., Albany, N. Y.

"Abbe" Bolt Forging Machines and "Palmer" Power Hammers a specialty. Forsaith & Co., Manchester, N.H.

List 28, describing 3,000 new and second-hand Machines, now ready for distribution. Send stamp for same. S.C. Forsaith & Co., Manchester, N.H., and N.Y. city.

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Jas. P. Hotchkiss, 84 John St., N. Y.: Send me your *free* book entitled "How to Keep Boilers Clean," containing useful information for steam users & engineers. (Forward above by postal or letter; mention this paper.)

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Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) H. L. writes: 1. Please let me know how to make a top which is kept in motion by electricity? A. You will find an illustrated description of the electrical gyroscope on p. 335, No. 22, vol. XXXVIII., SCIENTIFIC AMERICAN. 2. What kind of acid is used for taking off the polish from glass beads and how to handle it? A. Use hydrofluoric acid. Dip the beads into the aqueous acid for a few minutes, then wash in running water, and dry in sawdust.

(2) H. W. asks: 1. What proportions of nitric and muriatic acids are strongest for dissolving gold? A. Use a mixture of 3 parts hydrochloric (muriatic) and 1 part nitric acids. 2. How may the gold and acid be separated so as to leave the latter pure for further experiment? A. Filter and evaporate the solution to dryness over a water bath, redissolve the residue in water, precipitate with a strong solution of pure iron sulphate (copperas), heat to boiling, filter, wash the precipitate, dry, mix it with a little powdered borax glass, and melt on charcoal or in a black lead crucible.

(3) N. L. T. asks: Of what is the substance composed that is used by frame makers for decorating frames? Its appearance is similar to putty. A. The substance referred to is composed of fine whiting and glue size. The size is dissolved in a small quantity of hot water and mixed into a stiff paste with the whiting for use.

(4) C. T. asks: Will a given volume of steam raise the same quantity of water by means of an injector as it would do if applied to the piston of a pumping engine? Or does steam through the jet of an injector exert its full mechanical energy on the water before being condensed, the full energy being that due to its initial or boiler pressure added to its expansive power between the initial pressure and the pressure of the head of water against which the injector works? A. In the injector the full mechanical effect is not attained as in the best engines.

(5) D. C. W. asks: Can you recommend anything special to me, through your SCIENTIFIC AMERICAN, to keep mincemeat, jellies, jams, etc., from working and spoiling? A. You should try Barff's new antiseptic, boric glyceride. See SUPPLEMENT, No. 332.

(6) H. M. G. writes: In a 16 foot 35 horse power boiler, would you advise filling up behind the bridge wall and carrying the inverted arch back from throat of the bridge wall to the end of the boiler? If so, how much space should be left, or how near to the bottom of the boiler should the arch be built? A. Yes; leave eight or nine inches space between the boiler and the inverted arch.

(7) H. S. writes: Myself and friend have got into an argument, from which we have decided you shall help us out. Dispute is this: I say one ton of coal coked is capable of making one ton of pig iron from ore that contains seventy-five per cent iron. He says it takes two tons. A. Coke furnaces average 3,000 pounds coke to one ton of iron; but with extra good furnaces and ore it may be as low as 2,000 pounds, and in exceptional cases somewhat less.

(8) J. B. asks: Which are the best and most recent publications considering the manufacture of wines from gooseberries, currants, rhubarb, etc.? A. For recent practical works on wine making address the booksellers who advertise in this paper.

(9) J. H. M. writes: I am about to make an air pump, and I wish to make it as perfect an exhauster as possible. Would cast nickel make good valves, and would it be proper to have the barrel of cast brass lined with nickel? The cement used in fastening the glass plate to the pump, how is it prepared, and how used? A. A brass barrel will make a good air pump, if it is not too soft. If you decide to make a barrel have it and all the valves made of a composition of 16 parts copper, 2 of tin, and 1 of zinc. This is a tough, strong metal, and will wear smooth. The casting of nickel is difficult unless it is alloyed; then it becomes German silver, which if made hard will make excellent, but expensive, working parts. Ordinary beeswax is used in the ground ball joint.

(10) D. A. Y. writes: A friend and I have a dispute as to whether pure limestone, ground to the fineness of flour, is better than lime for a fertilizer. I claim that the pure limestone ground is best. He says that lime is best. Now we wish you to decide for us. A. Air-slaked lime is much the best.

(11) W. H. K. asks: How can I best make a filter for filtering roof rain water for drinking only—say two quarts per day? How can I keep it? Shall I filter and then keep, or filter slowly? Shall I keep in stone or wood? A. Procure a small quarter barrel with a tap near the bottom and another close to the top. Fill this vessel about one-sixth full of clean coarse gravel, then put over it an equal quantity of coarsely granular, well burned charcoal, freed from dust, and over this again another equal measure of fine gravel. Then fill up to within about three inches of the top with fine quartz sand and head up. The rain water reservoir is connected by a rubber tube or other suitable pipe with the bottom tap, and water is drawn from the upper tap slowly, as required. The filtration should not be allowed to proceed too rapidly. For drinking purposes stoneware or porcelain enameled iron vessels are better reservoirs than wood.

(12) A. W. G. writes: Would like you to inform me through the columns of your paper how I can make the cement used for fastening the rubber tubes on a bicycle. A. Melt together in an iron pan over a gentle fire one part each of gutta percha and shellac, and gradually stir into the mixture one-tenth each of melted sulphur and red lead. Use hot. It makes a surer joint if applied to very loosely woven fine cotton cloth or netting, which is then inserted between the parts to be joined. These should be held under pressure for several hours to allow the cementing material to set before putting under strain.

(13) L. McN. writes: I wish to produce an intense heat in a small blast furnace. If I use coke and a blast of oil (in the form of an atomizer for fuel, will it produce the desired result? A. You can warm the air blast by causing it to pass through a coil of heated metal tubing, and then cause this warm blast to pass through a small quantity of benzine before projecting into the tuyere (or its equivalent) of the furnace. It will be necessary to use small jets to avoid danger from the liability of this carbureted air to inflame and cause an explosion in the blast pipes and apparatus. You can use coke, or fine coal and coke mixed.

(14) F. B. writes: 1. I am building a post fence in alkali soil. The earth ends decay very fast. A good cheap preventive would be in demand. I have heard of coal tar being good. What is your opinion? A. The best method of protecting fence posts in such a soil is to char the ground end superficially and then dip the charred parts in melted coal tar. 2. Which should be best regarded, short cars or long cars on curves at fast speed, and why? A. Short cars, because they adapt themselves better to short curves.

(15) S. R. W. writes: I would like to know what is the best available application (paint or other wise) to the outside of a galvanized iron boat, to protect it from the corrosive action of salt water, and also, perhaps, from barnacles. A. If the dark color is not objectionable, lay on several coats of finest quick-drying japan varnish, letting each get quite hard before applying the next. The last coat may be a flowing one if a very smooth surface is desired.

(16) J. G. M. writes: In No. 23 of the SCIENTIFIC AMERICAN I find an article on crystalline glass, which reminds me of some of my own experiments. One day (in the winter) I was staining some boards imitation walnut with a water stain, setting them away to dry; afterward I found that the stain froze and had formed some beautiful crystals, as seen on our windows in winter. This led me to experimenting on the subject. I prepared some pieces, stained them, and immediately exposed them to the cold winter atmosphere. As soon as the stain was frozen I removed them into a warm room, letting them gradually thaw out; the peculiar markings remained on the wood, and when thoroughly dry it could be varnished and finished in the usual way. I obtained some most beautiful designs in this way. I found that the quicker the stain freezes the better the result. Now, I would ask you to inform me if there are any salts that will crystallize and can be used in the same manner on wood, so as to make the work possible in summer as well as in winter? A. Try warm concentrated solutions of lead acetate, ammonium, chloride, sodium sulphate, and potassium ferricyanide and ferrocyanide.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

July 4, 1882,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1836, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 361 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Acid, etc., device for expressing stearic, G. J. Dannecker 260,543
Alarm. See Burglarm alarm. Clock alarm.
Amalgamating gold and silver ores, apparatus for, W. Hamilton 260,380, 260,380
Amalgamator, ore, B. Hershey 260,532
Ash barrel and coal hod cover, J. A. Brown 260,384
Atomizer, T. E. Studley 260,505
Auger, W. L. Parmelee 260,497
Ax and brush hook, L. T. Shelton 260,473
Bag holder, J. R. Pendleton 260,707
Bale band replacer and tightener, W. R. Lenard 260,402
Bale tie, J. B. Allen 260,515
Bales and bundles, wire tightener for, L. Miller 260,709
Bar. See Chain bar. Horseshoe blank bar.
Battery. See Secondary battery.
Bearing, rolling, F. W. Marston 260,508
Beds, head rest for cot, H. D. Hard 260,677
Beds, head section for, E. F. Meier 260,405
Beer, etc., cooler for, A. Zoeller 260,630
Bench. See Wash bench.
Bird skin, ornamented, A. H. Ward 260,629
Blind-slat adjuster, G. W. Springsted 260,672
Block. See Sawmill head block.
Blower and damper for grates, combined, G. W. Ranson 260,413
Board. See Wash board.
Boat, J. Dean 260,409
Boiler. See Steam boiler.
Boiler tube expander, Z. J. Ferguson 260,855
Boilers, sediment collector for, D. Hanna 260,676
Bone black and revivifying old bone black, treating new, S. M. Lillie 260,486
Bone blanks for tooth brushes, machine for milling, A. C. Estabrook 260,376
Bone into blanks for tooth brush handles, working, A. C. Estabrook 260,374
Bone sawing machine, A. C. Estabrook 260,375
Book holder, J. Pusey 260,500
Boot, W. Smith 260,426
Boots and shoes, manufacturing felt, J. K. Felck 260,554
Boring machine, C. D. Blevins 260,362
Box clamp or fastening, O. P. Retaour 260 606
Bracelet, S. Cottle 260,549
Brake. See Car brake. Carriage brake.
Brush, electric, J. W. Weakley, Jr 260,718
Brush handles, machine for boring, A. C. Estabrook 260,377
Brush handles, machine for graving, A. C. Estabrook 260,378
Buckle holder, E. R. Cahoone 260 450
Buffing wheel, H. E. Fowler 260,558
Burglar alarm, electric, C. E. Chinnock 260,536
Burner. See Lamp burner.
Button, glove, E. Pringle 260,611
Calendar and letter box combined, W. L. Caldwell, 260,531
Camera. See Photographic camera.
Can. See Sheet metal can.
Cane stripper, sugar, E. P. Putnam 260,709
Car brake, B. F. Smith 260 618
Car coupling, J. H. Smith 260,619
Car coupling, D. W. Woods 260 735
Car safety step, S. M. Beery 260,535
Car, stock, C. W. Rogers 260,421
Car wheel, E. B. Mestyard 260 506
Cars, propulsion of street, R. F. Bridewell 260,648
Cars, sand box for street, G. F. Huntington 260,572
Card tooth, G. Petty 260,466
Carriage brake, E. S. Davis 260 543
Carriage, child's, J. W. Krueger 260,389
Carriage curtain fastening, F. Westwood 260,719
Carriages, canopy support for children's, Butler & McClinchie 260,540
Carrier. See Trace carrier.
Car, road, C. W. Watson 260,434
Case. See Clock case. Photographic picture case.
Caster, table, Banghart & Trost 260,355
Caster, trunk, J. J. Cowell 260 726
Casting apparatus, W. Hainsworth 260,388
Centrifugal separator, E. B. Quimby 260,412
Chain bar and pencil, combined watch, L. W. Fairchild (r) 10,147
Chain, drive, C. H. Labelle 260,400
Chair. See Railway chair.
Chimney ventilator, H. Hahn 260,504
Chopper. See cotton chopper.
Churn, R. Campbell 260,451
Cigar bunches, forming and drying, J. J. Bach 260,626
Cigar press, H. J. Watteyne 260,510
Clamp. See Box clamp. Whip socket clamp.
Cloak, C. F. Hamilton 260,565
Clock alarm, O. H. Woodworth 260,514
Clock case, H. J. Davies 260,544
Clothes wringer, bench, M. A. Jones (r) 10,148
Clutch, friction, F. O. Deschamps 260 460
Clutch, friction, J. A. Hafner 260,386
Clutch, friction, D. McIntosh 260,698
Coffee, roasting, J. W. Drummond 260,674
Compressing dry and plastic materials, machine for, C. Kilgore 260 578
Connecting rod coupling, J. C. Brannon 260,448
Cornice, window curtain, H. H. Winger 260,439
Corpse supporting table, T. Condon 260,665
Cotton, device for handling, C. H. Merry 260,403
Cotton chopper, B. J. Curry 260 458
Cotton gin, J. E. Carver 260,000
Cotton gins, combined feeder and breaker for, J. E. Carver 260,661
Coupling. See Car coupling. Connecting rod coupling. Pipe coupling. Shaft coupling.
Crate. See Fruit crate.
Crucible furnace and brick for constructing the same, H. Swindell 260,629
Culinary vessel, J. W. Fisher 260,470
Cultivator, Berlew & Kissell 260,447
Cultivator, Colton & Schermerhorn 260,664
Cultivator, J. L. Jensen 260,686
Cultivator, J. G. Jordan 260 576
Cultivator, J. Weymouth 260,720
Curtain fixture, A. B. Shaw 260,616
Desk, J. A. Moore *et al* 260,703
Drains, etc., in cement, apparatus for forming underground, W. M. Campbell 260,593
Drill. See Ratchet drill.
Drop handle, C. S. Barnard 260,589
Ear ring, G. Krements 260,692
Eaves troughs, machine for making, G. Huth 260,481
Electric condenser, S. Borden 260,646
Electric current generators, thermic regulator for, C. F. Brush 260,651
Electric lighting, Starr & Peyton 260 624
Electric machine, dynamo, C. F. Brush 260,652
Electric machine, dynamo, J. A. I. Craig 260,541
Electric machine, dynamo, C. Heisler 260,480
Electric machine regulator, dynamo, J. H. Irwin, 260,575
Electric motors, controlling, E. T. Starr 260,623
Electric wires, underground conduit for, J. S. Du Bois 260,548
Electro motor, J. H. Irwin 260,574
Elevator. See Hay elevator.
End gate, wagon, R. Barnard 260,521
Engine. See Gas engine. Gas motor engine. Lever engine. Rotary engine. Steam engine. Traction engine. Wind engine.
Engraving machine, J. Earle 260,463
Engraving script, J. Earle 260,464
Excavating earth for sinking tubing, C. H. Leach, 260,486
Extractor. See Stump extractor.

Fare register, J. B. Benton 260,526
Faucet, J. H. Seabury 260,615
Feather renovator, S. Tate 260,626
Fence, T. B. White 260,436
Fence post, iron, F. Schmitz 260,614
Fertilizer distributor, W. B. Allen 260,444
Fibrous plants, machine for cleaning the leaves of, A. Angeli 260,518
File, bill, W. R. Clough 260,537
File block holder, W. H. Inslee 260,595
Firearm lock, W. Mason 260,586
Fire escape, A. Bühmer 260,429
Fire escape, Townsend & Dubey 260,627
Fire escape, C. P. Wilson 260,722
Fire extinguisher, J. W. Bishop 260,639
Fire extinguisher, automatic, J. W. Bishop 260,640
Fire extinguishing apparatus, J. W. Bishop 260,641
Fire kindler, J. H. Davis 260,529
Flour dressing machine, W. D. Gray 260,477
Flower stand, A. T. Lundqvist 260,696
Food products from distillery swill, apparatus for recovering, W. H. Smith 259,427
Form, dress, T. R. Fischer 260,556
Frame. See Slate frame.
Friction movement, J. A. Horton 260,594
Fruit crate and packing box, knockdown folding, C. E. Bartram 260,567
Fruit press, hand lever, A. J. Hunt 260,571
Fumigating and preserving food, apparatus for, F. Macholdt 260,459
Fur and other goods, ornamenting, A. Mayer 260,589
Fur, etc., machine for working, felting, napping, and sizing, I. Gill 260,475
Furnace. See Crucible furnace. Ore deoxidizing furnace. Smoke preventing furnace.
Gas apparatus, R. H. Smith 260,712
Gas engine, A. P. Massey 260,587
Gas engine, C. M. Sombart 260,620
Gas motor engine, W. H. Wigmore 260,513
Gasket for steam joints, metallic, Tennant & Hattersley 260,506
Gate. See End gate.
Gate, J. E. Blackburn 260,643
Gate, J. Kirkpatrick 260,579
Gate, E. G. Wood 260,440
Glass, artificial stained, J. O. Fowler, Jr 260,559
Glass mould for the manufacture of chimneys and globes, Paull & Miller 260,498
Gong, street car, J. M. Matheny 260,588
Governor for dynamo electric machines, current, C. F. Brush 260,650
Grain binder, J. F. Appleby 260,634
Grain binder, S. D. Locke 260,497
Grain binder cord holder, C. W. Levalley 260,485
Grain binding machine, S. Nelson 260,496
Grain binding mechanism, J. S. Davis 260,668
Grain drying apparatus, N. W. Hawkenson 260,567
Grave signal, A. Fearnaught 260,479
Grinding circular knives and plow colters, machine for, C. M. French 260,560
Grinding mill, roller, J. Dawson 260,669
Hair, comb device for dyeing, M. N. Butron 260,367
Hair restorative, C. Hughes 260,570
Hame, J. G. Eberhard 260,549
Hame fastener, D. G. Miller 260,597
Handle. See Drop handle. Plow handle.
Harrow, J. M. Johnson 260,687
Hatchway door, automatic, E. M. Hackett 260,675
Hats, machine for sticking and stniding naps to felt, S. C. Palmer 260,608
Hay elevator and carrier, J. H. & P. Lux 260,697
Hedge trimmer, G. Reed, Jr 260,606
Hides and skins, fawing and coloring, C. Richter 260,418
Hinge, H. A. Wilbur 260,437
Hinge, J. D. L. Bixby 260,361
Hoe, E. W. Boyle 260,363
Hoisting apparatus cylinder, A. Granville 260,564
Holder. See Bag holder. Book holder. Buckle holder. File block holder. Grain binder cord holder. Pillow sham holder. Ruling machine pen holder. Sash holder.
Hook. See Snap hook.
Hoop gauging apparatus, H. Wilde 260,438
Horse blanket, C. H. Frost 260,472
Horseshoe blank bar, J. N. Clarke 260,451
Hub, vehicle wheel, J. B. Blatt 260,644
Hydrant, R. M. Hunter 260,597
Ice from car tracks, clearing, J. M. Elliott 260,550
Inhaler for ether, etc., M. Matter 260,408
Ink, fluid, J. J. Magne 260,583
Ironing machine, A. G. Yerbury 260,727
Isographic process, J. J. Magne 260,584
Key. See Telegraph key.
Lamp, W. S. McLewee 260,592
Lamp burner, J. M. Fife 260,469
Lamp, electric arc, S. Borden 260,647
Lamp, electric incandescent, H. J. Müller 260,600
Lamp, kerosene oil, T. P. Thompson 260,450
Lamp or lantern globes, chimneys, etc., manufacture of, Paull & Miller (r) 10,140
Lamp switch and indicator, electric, Greenfield & Bradley 260,562
Land scarifier, grass, W. J. Burdick 260,529
Latch, F. J. Lee 260,496
Latch, gate, D. W. Barr 260,355
Latch, gate, P. J. Winn 260,929
Leaching apparatus, S. Strunz 260,714
Leather coloring compound, light, C. Richter 260,416
Leather, preparing a solution for dyeing or staining, C. Richter 260,417
Leather punching machine, W. Foglesong 260,561
Leather scouring, setting, and hide working machine, J. C. Mayer 260,493
Lever engine, swinging, J. Von Zäch 260,509
Lifter. See mowing machine cutter bar lifter.
Lime and cement, manufacture of hydraulic, E. J. De Smedt 260,548
Lock. See Firearm lock. Nut lock. Wagon brake lock.
Mat. See Wooden mat.
Meat cutter, A. Metz 260,595
Meat tenderer, I. W. Heysinger 260,566
Mechanical movement, J. A. Hafner 260,567
Metal plates to sheet rubber, machine for attaching, J. L. Thomson 260,631
Metallic straps or bands, machine for straightening, L. Miller 260,701
Mill. See Grinding mill. Roller mill. Windmill.
Monkey wrench, C. Richards 260,609
Motion, device for converting, S. O. Campbell 260,452
Motor. See Electric motor.
Motor, N. A. Baker 260,352
Mowing machine, A. D. Hamlin 260,591
Mowing machine cutter bar lifter, H. R. Allen 260,761
Mowing machine track cleaner, C. W. Love 260,581
Music, sheet, T. C. Damborg 260,372
Mustard filler, J. Guiden 260,385
Nailing machine, A. Van Wagenen 260,718
Needle blanks, machine for swaging, J. H. Bullard 260,665
Nut lock, A. E. McConnell 260,591
Nut lock, M. Wallace 260,679
Nut lock for screws, etc., H. Kemmler 260,580
Nut lock washer, spring, A. D. Holland 260,684
Oar and oar lock, M. Chase 260,370
Oil, compound, E. F. Dieterichs 260,670
Ore concentrator, centrifugal, A. D. Clarke 260,453
Ore deoxidizing furnace, iron, I. D. Condit, Jr 260,539
Organ stop action, reed, G. B. Kelly 260,577, 260,689
Pan. See Water closet pan.
Paper board composed of wood pulp, manufacture of, F. E. Heath 260,680
Paper machines, automatic wire guide for, T. P. Barry 260,356
Peas, machine for shelling green, A. Meyer 260,494
Petroleum, etc., apparatus for vaporizing and burning, D. M. Graham 260,476
Photographic camera, M. Flammang 260,557
Photographic camera, H. C. Price 260,605
Photographic picture case; J. H. Caterson 260,535
Pie crust, machine for trimming and crimping the edges of, L. C. Camp 260,369
Pillow sham holder and lifter, E. W. Rider 260,710
Pipe coupling, T. G. Knight 260,580
Planers, feed roller for wood, E. H. Herndon 260,569
Planter, corn, E. M. Miles 260,700
Planter, cotton, W. T. Burrows 260,656
Planters, hand lever and device for marking guides of, J. J. Farrar 260,553
Pliers, cutting, T. D. Hotchkiss 260,595
Plow handle, T. M. Bissell 260,642
Plow, harrow, seeder, etc., combined, T. E. Jefferson 260,492
Plow or spader and roller, combined revolving, E. M. Miles 260,596
Plow, sulky, W. L. Casaday 260,534
Plowing and tilling apparatus, J. Felerabend 260,673
Plumber's trap, P. Connolly 260,666
Pool player's portable position register, W. Zachringer 260,442
Potato sprouts, machine for removing, E. Payne, 260,407
Power press, G. B. Boomer 260,528
Preserving food, process of and apparatus for, O. Parker 260,706
Press. See Cigar press. Fruit press. Power press.
Printer's quoin, O. C. Springer 260,621
Pulley, H. R. Allen 260,350
Pulley for gates, sheave, C. E. Ackerman 260,632
Pulley, separable, Dodge & Philion 260,462
Pump bucket, P. J. Ritzdorf 260,730
Pumping apparatus, electric, Peck & Chapman 260,408
Puzzle, geometrical, E. Mehner 260,594
Radiator, Wheat & Catchpole 260,512
Rails device for connecting, O. Benson 260,446
Railway, elevated automatic, W. F. Sherman 260,617
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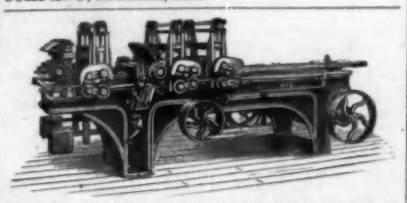

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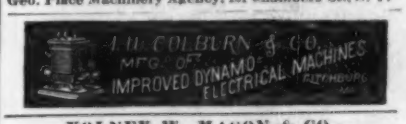

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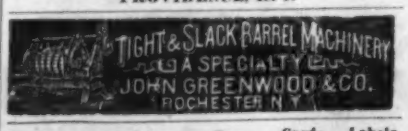

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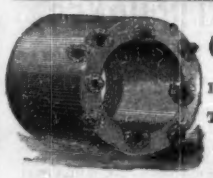

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The President of the United States of America, to Samuel C. Anderson, his attorneys, agents, employees, servants, and workmen:

GREETING:—Whereas it has been represented to us in our Circuit Court of the United States, for the second Circuit and Southern District of New York, that Letters Patent of the United States were issued in due form of law, on the 1st day of June, 1880, to Charles Henry Green, for a new and improved dry process and apparatus for producing multiple copies of writings, drawings, and other delineations, said patent being known and distinguished as No. 228,362, and which said Letters Patent belong exclusively to the Hektograph Manufacturing Company, and that you, Samuel C. Anderson, have infringed the rights secured by the aforesaid Letters Patent, by making, constructing, using, and vending to others to be used, the invention set forth in said Letters Patent, and by making, constructing, using, and vending to others to be used, apparatuses or articles made according to and employing and containing said invention, which said apparatus or article is designated by you as the Copygram and other names, contrary to the form of the Statute in such case made and provided.

Now, therefore, we do strictly command and perpetually enjoin you, the said Samuel C. Anderson, your attorneys, clerks, agents, employees, servants, and workmen, under the pains and penalties which may fall upon you and each of you in case of disobedience, that you forthwith forever desist from making, constructing, using, or vending to others to be used, in violation of said patent, or in any manner disposing of Hektograph, Copygram, or any article embracing the invention or process made and manufactured substantially as described and claimed in the said Letters Patent.

Witness HON. MORRISON R. WAITE, *Chief Justice of the Supreme Court of the United States, at the City of New York, this 1st day of July*, 1882.

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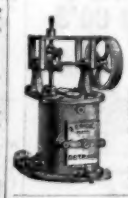

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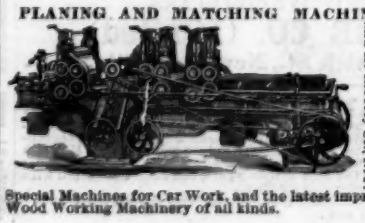

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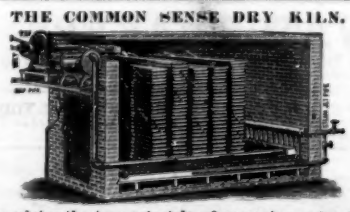

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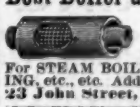

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